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THE BELOVED PHYSICIAN

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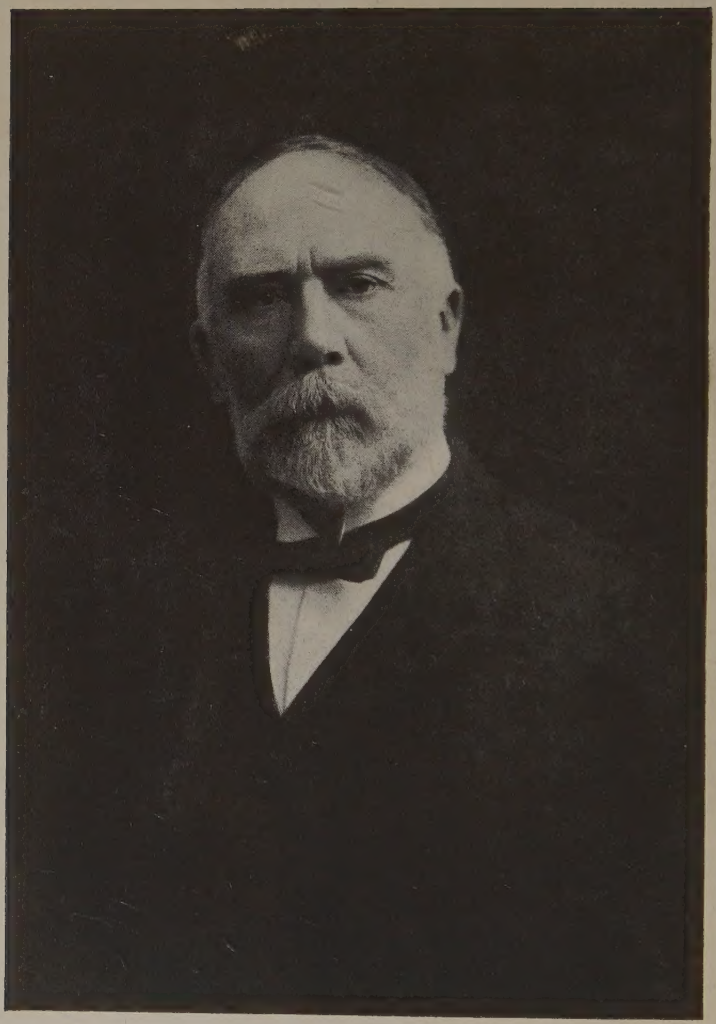

J Mackenzie

THE BELOVED PHYSICIAN

SIR JAMES MACKENZIE

A BIOGRAPHY BY

R. McNAIR WILSON

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PREFACE

I HAVE tried, in these pages which follow, to describe a great man.

If it may seem that some of the passages of the book are inspired by bitterness or unkindness or sarcasm, I would have my reader know that all these are directed first, and most of all, against myself. For I was of that company who worked with him; and yet I did not grasp his meaning nor his aims till the day was far spent. Only his goodness, in that he laboured to enlighten me through many months and years, opened my dull eyes.

This man was not as other men. His criticisms and his strictures were spoken because, in his soul, he knew and felt the need to speak them. He loved that great profession which he so signally adorned, with a deep and passionate love, was jealous of its honour, bold in its defence. But he saw the weaknesses which beset it, and raised his voice to warn it of its danger.

For myself, I owe to him all of that little that I know of medicine. I held him in love and reverence. I have written of him as a humble follower writing of his Master.

I wish to take this opportunity of thanking Sir William Mackenzie, K.C., Sir James Mac-

kenzie's distinguished brother, for the invaluable help he has given me, and also of expressing my deep indebtedness to Lady Mackenzie and Miss Dorothy Mackenzie for those intimate lights on home and family life which are of the essence of any study of character.

R. M. WILSON.

1*st February*, 1926.

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"THE BELOVED PHYSICIAN"

THE room was dark, towards evening, but a fire burned in the grate, casting its cheerful light on the face of my companion, Sir James Mackenzie. He sat, leaning forward in his chair, eagerly, with that quick enthusiasm of word and look which is commonly associated only with youth. His tones were serene in their confidence.

"It is extremely difficult for many medical authorities to understand my point of view. . . . I have described it as fully as I can. . . . I think that we have made progress. Perhaps twenty years hence. . . ."

He broke off. A look of suffering gathered in those fearless eyes.

". . . When I talk of these subjects now, it is apt to bring on the pain. . . ."

Silence fell between us, the silence of London houses, which is set, always, against the rhythm of the city's life. The firelight gave me his grand features once more; that truly noble brow, a temple worthy of the mind which it sustained, the rugged strength of his nose and mouth; above all, the kindness of his eyes. He was smiling into the firelight. Then he spoke again.

"I am not afraid of death," he said simply. And then, "A man with angina pectoris is like one of those old martyrs, confined in a room the walls of which gradually folded inwards and crushed him. . . ."

The smile had not faded from his lips, nor the kindness from his eyes. He, who could measure so well the march of the fatal disease which advanced against him, viewed that march undismayed. He knew that his life was accomplished; knew, too, as a man must know, that he had wrought a man's work and given grandly of all that he possessed. . . .

When I rose to leave him, he switched on the lights and came with me to the door of the room. His tall figure stooped a little, but that was the only mark which the fell disease had set on him. The old-time impression of strength was still there; the old-time joy and mirth of very sweet and very simple natures. No wonder his working-class patients in the Northern town called him "the beloved physician" in those far-off days before his name rang through the world as the maker of a new conception of the physician's art!

That memory of the slightly stooping figure, of the man rich in achievement and full of service, yet with the eyes of a boy, remains now and will always remain. It is a memory most hallowed and most gracious. Mackenzie was a great doctor, the greatest, I believe, of our generation. He was a great man of science, a great observer, a great thinker, a great controversialist. But over and above all these things he was a great man, a

great friend, true in heart, noble in spirit, dauntless in courage.

* * * * *

I would like to set against that picture another, which was Mackenzie's earliest memory of his own life. It is the picture of a child of five years of age, setting forth from a Scottish farm to go to school for the first time. The small lad was eager to go, and so make a beginning of his work in the world. But he has left it on record that when he returned home again, after the first day's work, he announced that his education was finished. He had had enough of it.

BOOK I

"THE DUNCE"

"If you ask what is the first step in the way of truth, I answer humility. If you ask what is the second, I say humility. If you ask what is the third, I answer the same—humility."

CHAPTER I

COLOURED LIGHTS

James Mackenzie was a Highlander of an ancient stock. The family came from the neighbourhood of Dunkeld in Perthshire, that exquisite town, set on the banks of the Tay, with its splendid Abbey and its pine-clad hills that rise so stark towards the great mountains. His father, Robert Mackenzie, and his mother, Jean Campbell Menzies, had, however, migrated to the parish of Scone before his birth, and were settled, when that event occurred on April 12th, 1853, in the farm of Pickstonhill. Thus the boy, their third child and second son, made his first contacts with life in the very cradle of Scottish history. But a stone's-throw from his home, beyond the surrounding woods, stood the ruins of the ancient abbey where, from remotest antiquity, the Kings of Scotland were crowned and where, on the actual Stone of Destiny, they were anointed with the sacred oil. And close to the abbey was the Palace of the Kings, built within easy reach of their good city of Perth. Dunsinane and Birnham, too, names charged with magic enough, lay east and north of the farm which faced, across the

Valley of the Tay, the frowning *massif* of the Grampians.

These circumstances of story and of Nature spoke to the boy's spirit. Young James had the romantic ardour of his race, that love of beauty, whether enshrined in tradition or expressed in actual lineaments, which is a part of the Highland character. He possessed this rich heritage, as only boyhood can possess both Past and Present, mingling them with its dreams. There were days when he brought his brothers and sisters through the deep woods to the Cross of Scone—a cross standing isolated and widowed of its town—and in vivid words restored to them the vanished glories of Chivalry. On such occasions he would let his imagination run riot, so that the spaces of the woods were peopled with kings and queens and great knights, and the silences of the woods made musical with their laughter.

Every Scottish boy is embued with the history of his race, but this boy added his own enthusiasm to that common stock of interest. Romance, the impulse to live greatly, held him, apparently, spellbound. The kings and the queens, the barons and the knights, the men of the Scottish Parliament—these stood for him, perhaps, as symbols of life itself, the abounding grace which, from the beginning, has transformed all things to its image. He felt life as a spirit, and in the dim woods and in the meadows of this dominion, joined himself to her.

That union was, I think, the secret of his success and of the amazing youthfulness of his

mind. Mackenzie studied life because he loved life in all her manifestations. It was no accident which determined that the title of the last and greatest of his scientific papers should be *The Basis of Vital Activity.*

Romance, however, has but seldom seduced a Scottish lad from the immediate business of his work. On the contrary it is usually a mainspring of effort. The boy who was ready, in his leisure moments, to sup and make merry with kings, was diligent in his application to his school work. Day after day he fared forth from the farm to the town, to wrestle with the "fundamentals" of a sound education. He was a pupil, first, of the village school—one of those parish schools which were established in Scotland at the time of the Reformation, and later, at the age of twelve, the Grammar School or Academy at Perth, an institution of such great antiquity that even the time of its foundation is unknown. The Grammar School was a place of repute in 1153, in the reign of King Malcolm IV. In 1550 one Andrew Simson "taught Latin there, with success, to some 300 boys. Among its most distinguished pupils was William Murray, a native of Scone, who became Earl of Mansfield and Chief Justice of England, and who, by a series of masterly judgments, framed the code of the commercial law of this country."

It does not appear that James Mackenzie distinguished himself as a scholar. He who has learned to love life with his whole heart, takes unkindly, as a rule, to the pale reflection of

life which books, and especially school books, afford.

"The things that I remember most clearly about my school education," he said once, "were that I was considered a dunce at most of my classes, and that the subjects in which I did well were those in which my understanding, rather than my memory, was called into play."

Nevertheless, these were days of many friendships and satisfactions, as is shown by the article he contributed in 1922 to the *Young Barbarian*, a magazine connected with his old school. In that article reference was made to "Pat Geddes" —now Professor Patrick Geddes—as "a nice-looking, plucky little chap. . . . I remember a great fight he had on the North Inch with a boy belonging to a different school."

The late William Archer, the famous translator of Ibsen and author of *The Green Goddess*, was another class-fellow of these days. Archer lived in Scone, and he and Mackenzie used to travel to school together each day.

"I have still," Mackenzie wrote, "a distinct recollection of my first introduction to the immortal Pickwick. Walking home one afternoon, I overtook Archer reading a book, but stopping every now and again to yell with laughter. When I asked him what he was reading, he told me it was Dickens's famous novel. A few years ago we were lunching together in a London club, and fell to comparing our meal with those of the Spartan days of our youth. I said I thought I

was allowed three-halfpence for my dinner. Archer remarked, 'You must have been a millionaire. I was only allowed a penny. If I spent it on buns at midday, I felt starved by 4 o'clock, so I used to buy a halfpenny bun and a halfpennyworth of sweets. I sucked the sweets on the way home, and they put off the craving for food.' "

The stern discipline of these days seems to have left no bitterness in Mackenzie's mind. He was not starved of the things which he really valued—the contact with life, romance, intellectual excitement. Indeed, only one incident of his schooling was ever mentioned by him in a hostile spirit—an incident in which, as he felt, injustice was done. Here is his description of it:

"On a bitter cold, windy day, because the roads were covered with snow and slippery, I was five minutes late for school. My hands were tingling with cold. 'Bulldog' Smith took up his cane and with all his strength gave me a 'palmy.' The cane hit right across the end of my half-frozen thumb, and the agony remains in my mind to this day as the severest pain I ever experienced."

Mackenzie left school at fifteen at his own request, and with the consent—reluctantly given—of his father. He was "terribly weary" of the place, and had outgrown his boyish enjoyment of it. He carried away as perhaps his chief, certainly as his most abiding impression of school life, a sense of bewilderment. Why did teachers,

all teachers, set so great a store by the exercise of the memory, and so small a store by the exercise of the reason? Why was a memory test—an examination—accepted as the final test of intellectual capacity? The lad of fifteen could not answer these questions. But they troubled him. He had not yet, apparently, so much as dreamed of rebellion against established opinion, yet his instincts were in revolt. That powerful mind fretted in an atmosphere of routine and uninspired authority.

It is a characteristic of the romantic temperament that it demands for its satisfaction, above all things, the stimulus of action. Stagnation is hateful to it, and it rejects with vehemence every static conception of human existence. Life moves —so runs the creed of romance—in swift and eager procession, and man's work is to facilitate that movement and, if possible, accelerate its pace.

But the romantic temperament has its weaknesses. It is recorded of the knights of the age of chivalry that they were sudden and swift in their resolutions, so that, not infrequently, vows were made and pledges given before the full meaning of these was realized. Such dangers still threaten the fervent spirit, especially in its moments of reaction from disappointment. Returning home one night from school, weary and uninterested, Mackenzie came suddenly to the lighted windows of a chemist's shop, in which sundry great jars of coloured water glowed with seductive brilliance. The transmitted light from these jars made patterns, red and yellow and

green, on the pavement at his feet. By some alchemy of the senses, the colours were imprinted on his mind. . . . They became a symbol of light in darkness, of the glow of enthusiasm in a world of deadly routine, of life in the midst of inactivity.

The boy vowed there and then that he must be a chemist, and that he would enter that chemist's shop as an assistant.

It was the most important decision of his life, for there can be no doubt that it led, indirectly, to his ultimate choice of medicine as a career. He was wont to speak of it as if chance and his own impulsiveness alone had determined the issue. But there, or so I think, he did less than justice to his nature. The lighted jars may have been an accident; but the emotions which they stirred were not accidental. These emotions, a vague but powerful desire to serve his fellows, and a wish to realize himself in that service, would have found their expression in any case. Mackenzie, as his dispirited steps approached that garish window, stood, in fact, on the threshold of life. He was waiting, with senses alert, the first whisper that should bid him cross that threshold.

See him, then, become the apprentice of the good chemist of Perth city, a lad eager to work for mankind in the splendid effulgence of the coloured lights. Alas! these glowing jars, when one has entered the shop and come to the backward of them, are transmuted, one and all, to the same drab hue. The chemist's shop, like the bench at school, was heavy with routine and monotony.

CHAPTER II

THE LAMP IN THE WINDOW

And very soon Mackenzie tired of the chemist's shop, just as he had tired of school. The hours were long—twelve hours on each weekday, fifteen hours on Saturday and four hours on Sunday. The duties, too, were humble. He fell victim to depression and to that sense of failure which so often troubles the dreams of youth.

He longed to be quit of his apprenticeship. He spoke of being quit of it and, by this display of impatience, caused his good parents some uneasiness. It was unthinkable that the solemn articles of an apprenticeship could be thus lightly broken! The lad's mother gave herself earnestly to the task of cheering him up, and of encouraging him to stay at the shop until his term was fulfilled.

She was a gracious and a goodly character, with that strength of purpose and courage in adversity which the mothers of exceptionally able men so very frequently display. Mackenzie owed to his mother on the grand scale, and rejoiced in the debt. She had an immense influence over him, especially over his native impetuousness. Her womanhood, by its persuasiveness, seems on this,

as on other occasions, to have quelled his impatience, while her authority won him to a serious view of the responsibilities which he had undertaken. He decided to go on with his work in the chemist's shop.

And so the young knight suffered that disciplining of his spirit which is the needful prelude to any great adventuring—and at the instance of a noble woman, whose love for her boy was singularly clear-sighted. On the Saturday nights, when James could not arrive home before midnight, his mother was accustomed to pull up a blind of the farmhouse, and set a lighted lamp in the window, so that he might see this sign of welcome a mile or so away on his lonely journey. Mackenzie never forgot that lamp. What son worth the name of a man could ever have forgotten it ?

He settled down to work according to the honest and self-sacrificing tradition of his family —a tradition of which his father was a notable exemplar. Robert Mackenzie belonged to that yeoman Scottish stock which forms, and always has formed, the backbone of the Northern Kingdom. He was an elder of the Kirk, a man— in the description so dear to Scotsmen—" not slothful in business, fervent in spirit, serving the Lord." He was also a very able farmer, who appears to have introduced scientific ideas and methods—including a nine hours' working day—into his agriculture, at a period when others were content merely to follow custom. These methods saved the Mackenzies from the ruin

which befell so many Scottish farmers in the late seventies, when the disaster of falling prices was added to the calamity of a succession of bad harvests in which the corn sprouted in the fields, and a species of "murrain" broke out among the herds and flocks. The rents of the farms had, when the leases were drawn up, been based on high prices. Thus, they weighed with almost impossible severity on the now crippled tenants. Yet there was no remission by the landlords. Many Scottish farmers were forced to leave their native land and go to the United States or Canada. Those who remained, who, like the Mackenzies, were able to win through by dint of frugality, hard work and improved methods, retained in their hearts a deep sense of injustice. The uttermost farthing had been extracted from them.

The boy in the chemist's shop at Perth shared this sense of injustice to the full. He had witnessed the grim struggle made by his father, and had seen the effect of that struggle on his mother's happiness. Landlordism stood, in his eyes, as something hateful, something oppressive. Thus there was accentuated in his mind a feeling which is common to all Scotsmen—the feeling that they, and not the titular aristocrats of their country, are the true heirs of the great traditions and figures of the past.

That feeling explains the apparent contradiction in the Scottish character, whereby acceptance of the most advanced political doctrines does not in the least weaken the power of tradition over

the individual accepting them, nor dim in his eyes the glamour of romance. The truth is that the Scottish aristocracy never, as a class, won the love and respect of the Scottish people, as the English aristocracy won the love and respect of the English. So far as the great mass of Scotsmen are concerned, aristocracy as a national possession ended with the "Black Douglas." It began with Sir William Wallace, and was gloriously sustained by King Robert the Bruce. On the death of The Bruce, the tradition which he bequeathed—the tradition of courage in adversity, of the love of freedom, of frugality, and hard work—became enshrined in the hearts of the common folk. They, and not their overlords, are, to this day, the true heirs of the Victor of Bannockburn.

I mention this because it is material to the study of the character of any Scotsman. Every Scotsman is proud of his ancestry after the fashion of the members of an hereditary caste, and this pride accompanies him through life. On the other hand, every Scotsman realizes that he may lose caste if he fails to live up not only to the ideals, but also to the intellectual level of his people. Thus, every Scotsman fears the taunt of illiteracy above all other taunts, and desires most of all to acquire for himself—or, failing himself, for his sons—the status of a member of one of the learned professions.

The position, in the intellectual firmament, of a dispensing chemist is not, as a rule, a high one. Mackenzie, as he toiled behind the counter, making up the prescriptions of the local doctors,

or supplying the demands of those customers who preferred to doctor themselves, must have known many bitter moments. Intellectually—or so he thought—he was a failure. His schooldays had passed without signal honour. An untutored whim had tied him to a trade. In other words, he was sinking below the "level of brains"—if such a term may be used—of his own people.

For he was not in the chemist's shop because his father had immediate need of his earnings. Far from it. He had begged his father to take him away from school, importuning that good man to a reluctant consent. He had himself insisted that he must be a chemist. His humble position was of his own seeking, the direct outcome of his native impulsiveness, and of the exasperation he had felt at his inability to shine in the exercises of the Perth Academy.

He appears to have realized this with the honesty of vision which always characterized him. After the decision had been taken to work out his apprenticeship to the last day, he devoted what leisure he could command to reading, and appears to have "devoured" many of the works of Scott, Smollet, Fielding, Richardson, Dickens, Thackeray and others, to say nothing of Huxley, Darwin and Tyndal. This literary adventuring, at a moment when the knowledge was dawning that he had underestimated — grossly underestimated—his own mental powers, added to his vexation. Mackenzie, tied to the chemist's shop, turned in his bitterness to that hope (and despair) of so many strong minds in uncongenial cir-

cumstances: he wrote a novel and, later, collaborated in a play.

Both these writings have perished, so it is not possible to express any opinion on their merits. Probably they served their immediate purpose, and furnished the young man with an outlet for his feelings. Perhaps they contributed to the deepening and broadening of his mind which certainly occurred at this time. In any case, the "dunce" of the Perth Academy began to belie that title—which, be it noted, he had bestowed on himself. He became, and continued, an exceedingly efficient apprentice—so much so that, when he was twenty years of age, his employer offered to take him into partnership on the very easiest terms imaginable. This was a remarkable tribute to his ability, for the business was the largest and the most lucrative in Perth.

Mackenzie must have known as his apprenticeship continued that, little by little, he was winning his way to his employer's trust and esteem. In the chemist's shop, at any rate, he was not a failure. And the chemist's shop, after all, was life. There was this solid fact to offset against the Academy days. He appears to have concluded that his natural bent lay in a practical rather than in an academic direction.

In that view he was almost certainly confirmed by the doctors who visited the chemist's shop. Doctors, especially country doctors, have small faith in the teaching of the "schools." On the other hand, they have an immense faith in the mission of their own profession. Many of them

are prone to advise every likely young man they meet to "be a doctor"—and the eager chemist's apprentice, with his great head, his wise mind, and his good family connections, must have seemed a very likely young man indeed. It is easy to realize how the lad's thoughts were turned to Medicine as the way opened by Providence out of his difficulties. Here was a learned profession indeed; yet a profession demanding, as his contact with the Perth doctors had revealed to him, a high degree of practical wisdom and a diligent exercise of the reason. A horizon, attractive even as had been, years before, the shining bottles of coloured water, began to open behind the rows of jars and phials on the shelves around him.

Mackenzie saw himself as a doctor; and the vision made him glow with an enthusiasm of a kind very different from the facile infatuation which had brought him, in the first instance, to his apprenticeship. He knew now what hard, grinding work meant; he had tasted the bitterness, and also the sweetness, of humble toil. He had further overcome, to some extent at any rate, the sense of intellectual inferiority which his schooldays had imposed on him. The first doubts as to the worth of academic honours as a guarantee of intellectual capacity were entering his mind.

Yet he would not repeat the precipitate action which had made a chemist of him. There were to be no more coloured lights in his life. Romance hereafter should, he vowed, have her solid backing of common sense and experience. Instead of

making an immediate beginning with his medical studies as soon as his apprenticeship ended, he took a post as a chemist in Glasgow, and remained in it during a whole year—and this, in spite of the fact that his younger brother had already gone to Edinburgh University to study for the Ministry.

That year's work confirmed him in his determination to be a doctor. Indeed, he used his leisure to prepare for his first examination. Nor could the alluring offer by his Perth employer, to which I have referred above, turn him from this resolve.

His father and mother warmly supported him in his new enterprise.

The earnings of an apprentice in those days were not considerable. In his first year Mackenzie got £5 only. He received the first instalment of this, £2 10*s.* 0*d.*, at the end of six months, and that night ran all the way home to Scone, in his eagerness to give the money to his father.

CHAPTER III

THE REASONING TYPE OF MIND

MACKENZIE was twenty-one years of age when he went to Edinburgh to begin the study of medicine. That is to say, he was about four years older than the majority of the men of his "year."

But against that disadvantage he could set the facts that he was a skilled dispenser, that he knew something of life, above all, that he knew something of himself.

He shared rooms with his younger brother, Robert, then taking an Arts course, and destined ultimately for the Church. The two young men had no illusions. They realized that their father and mother were experiencing a very difficult time at home, owing to the bad conditions of farming, and that, in consequence, every penny counted. They lodged with a joiner, who was a married man with one child. The joiner and his wife and child lived and slept in the kitchen ; the Mackenzies had the "parlour," an apartment fitted with a "box bed." They had brought their own sacks of oatmeal with them from the farm at Scone, and, in addition, a supply of butter and scones and their linen. They had porridge for breakfast, some meat for dinner and tea, and bread and butter at night.

Strict accounts of all expenditure were kept, and these were submitted to their father on their return home.

The young men knew nobody in Edinburgh, and therefore paid no visits except to the lodgings of other students. But they went to the University debating society occasionally, and sometimes to evening lectures. They were also regular attenders at church.

James, however, had by no means left his troubles behind him in the chemists' shops. On the contrary, he rediscovered the very difficulties which had driven him, in the first instance, to these shops. The University of Edinburgh soon assumed a complexion strangely like that worn by the Perth Academy at the time when he had shaken the dust of it from his feet. Like Jonah, he returned from his adventuring, to find the problem, from which, as he supposed, he had made good his escape, still awaiting solution. In other words, the " dunce " was face to face, once again, with the academic system which had bestowed on him that ignominious title. Nor was the system less inexorable in its operation in Edinburgh than in Perth.

" The same difficulties," Mackenzie wrote, " arose as those which had troubled me in my schooldays. I was not taught how to study, and had great difficulty in passing my examinations in my early years. . . ."

This time, however, the " dunce " came armed with some weapons of defence. He was no longer

a schoolboy, and he was dogged in his determination to win through at all costs. He worked literally, like a slave, actually committing to his rather uneasy memory long passages from lectures, the very meaning of which was hidden from him. By such devices, supported by the courage of despair, he managed to scrape through the early, scientific part of his training, and come to the actual practice of medicine—the so-called " clinical work."

The change filled him with delight because, at last, his reason had free play. He began to make progress. In his last year at the University, he actually won three medals.

Even these medals, however, failed to convince him that he was other than a very inferior kind of student. The humiliation of the Perth Academy had bitten deep. He went about feeling that Providence had denied to him that superior wisdom by which genius is distinguished from the common herd. Years later, with his own experiences in his mind, he wrote :

" There are two very distinct qualities of the human mind : memory, and the power of reasoning. The earliest to be developed is that of memorizing, and this can be cultivated with great ease. The power of reasoning is quite different, although, no doubt, memory takes a part. When we look at a great number of students, we discover that this power of memory is greatly developed in a few, and that all our educational methods are devoted to its cultivation. Examinations are specially contrived for the purpose of discriminating

those with the best memories, and to them all the honours and prizes are given.

"The individuals who, on the contrary, possess more of the power of reasoning than their fellows, receive no consideration. There are minds which have a difficulty in remembering isolated facts, but if these facts are related in some consecutive manner, they can not only remember them, but also appreciate their bearing on one another. But this type of mind is slow in acquiring knowledge, and in our present-day methods of education less and less encouragement is given to this type of student. His peculiar powers are never developed, and their presence is never suspected.

"The outcome of the teaching of to-day is to hail the student with superior powers of memorizing as the brilliant student, and the one with the great future. The consequence is that his path from the outset is made easy for him. Bursaries and scholarships fall to his share, and before he has acquired any experience, he is appointed to a teaching post. In the absence of any knowledge acquired from the results of his own observations, he is forced to teach that which he was himself taught, and, as he cannot discriminate between truth and superstition, he hands both on to his students. As years pass he comes to believe what he has taught is true and may even grow impervious to new ideas which are contrary to the beliefs he has been expounding."

These eminently practical words have a certain pathos when their history is known. They were the only "revenge" which Mackenzie ever permitted himself against the educational system by and through which he had suffered so much.

Indeed, there were moments in his life when he seems to have felt that even the troubles of his schooldays were necessary to his mental development.

"Our old (school) teachers," he wrote once, "did not teach us much, but they were thorough, and so laid a basis on which we could build in after life, and in the struggle for existence, when we were pitted against the people with a 'superior education,' we were able to hold our own."

But though he asked no pity for his past troubles, and was ready to forget them easily, he could not undo the profound effect they had wrought on his own nature. The recognition of himself as one of those people who were endowed with the reasoning type of mind was the greatest discovery he ever made. It altered the whole course of his life, and made possible the rich harvest of achievement which was finally garnered. When Mackenzie graduated in the year 1878, he had already—without knowing it—begun to set his own course.

That year deserves some notice. It witnessed the opening stages of the battle which Pasteur in France, and Lister in Britain, were waging on behalf of the germ theory of disease. That is to say, it witnessed the beginning of a new conception of disease, a conception destined to capture the imagination of the whole world. Mackenzie was in the very thick of this tremendous upheaval. It is a curious and, for his biographer, a significant fact, that he seldom discussed it or wrote about it in after life.

Let there be no doubt in the reader's mind about the magnitude of what was afoot. Pasteur, a French chemist, had discovered that the souring of wine and milk was due to the presence in these substances of certain tiny living bodies, and had advanced, step by step, from this revelation to the stupendous conception of an invisible world—"the world of the Infinitely Small"—peopled with the hosts of life and of death. Lister, an Englishman, who had been appointed Professor of Clinical Surgery in Glasgow, had applied Pasteur's ideas to the conduct of surgical operations, with the most astonishing success. The whole world, literally, and not only the world of Science, watched these two men almost with breathless interest. And no wonder! For from the work of Pasteur was destined to come the modern science of bacteriology, and all those vast changes in the care of public health which have proceeded from that science; while from the work of Lister was to emerge the practice of surgery as we know it to-day.

Lister acknowledged from Edinburgh University his debt to Pasteur in the very year, 1874, when Mackenzie became a student of that foundation. He declared that he had been labouring for nine years to bring his antiseptic system to perfection, and added:

"Allow me to take this opportunity to tender you my most cordial thanks for having, by your brilliant researches, demonstrated to me the truth of the germ theory of putrefaction, and thus

furnished me with the principle upon which, alone, the antiseptic system can be carried out."

Four years later, in 1878, the year of Mackenzie's graduation, Pasteur delivered before the Academy of Medicine in Paris his famous address on the subject of putrefaction in wounds. He spoke as a man who was not a doctor himself, declaring:

"The water, the sponge . . . with which you wash or dress a wound, lay on its surface germs which, as you see, have an extreme facility of propagation within the tissues, and which would infallibly bring about the death of the patients within a very short time if life in their limbs did not oppose the multiplication of germs. But how often, alas! is that vital resistance powerless. . . ."

Pasteur went on to demand the killing of the germs as the only way of saving the patient from their attacks. But a few years later he was demonstrating to the world the fact that human resistance to germs may be so far raised that they cease to be able to inflict injury.

What was Mackenzie's attitude to this new doctrine? The answer is that it was an attitude of quite humble acceptance. The young doctor would not, at that time, have dreamed of measuring himself against Lister, or, indeed, against any recognized authority of his profession. He looked on himself as a very insignificant person indeed, and put away sternly any ideas of taking a part in the larger life of his profession. A few years before his death, he confessed that

"during my college career I felt a longing to devote myself to some of the branches of medicine concerned in research, but my very moderate attainments precluded me from obtaining any of the coveted posts about the University, and I quite clearly recognized that I was only suited for what is considered the lowest place in the medical profession."

Thus he prepared himself for general practice, and naturally did not concern himself greatly with other matters.

In other words, for the second time in his life he wrote himself down as an academic failure—a "dunce." And for the second time in his life—but this time deliberately—turned from the weariness of schools to the solace of life. His humble spirit accepted the low estimate of his abilities which some, at least, of his teachers appear to have formed. He comforted himself with the reflection that, in any case, he had secured his degree and achieved his purpose, in however undistinguished a fashion.

Moreover, general practice certainly attracted him, even at this time. His was far too "human" a character not to look forward with pleasure to the work of attending sick folk and becoming their champion in hours of need. There is plenty of evidence that the battle of life against death which every serious illness reproduces exercised a deep fascination on his eager and generous spirit.

Thanks to the urgings of his friend, Dr. John Brown, he applied for a Resident post at the Edinburgh Royal Infirmary—as the best possible

preparation for the work which he was about to take up. He had no expectation of obtaining this post, and was not a little surprised when he learned that he had been appointed.

The month was July. The House appointment did not begin till November. It was necessary, in the meanwhile, to live and to save enough money for the "lean" months to be spent in the Infirmary—for these House appointments are unpaid. Mackenzie, following the usual custom of young doctors, entered his name for *locum tenens* work, and was soon busy in the conduct of a colliery practice at Spennymoor, County Durham, where he received two pounds per week and free board.

That practice was a revelation to him. It was one of the old "club" practices in which the head of each family paid sixpence a week to the doctor as an insurance against all and every form of visitation. The Durham collier is an excellent fellow, but he likes to obtain value for his money, and value in this case meant bottles of physic. The astonished *locum tenens*, fresh from his University training and with the memory of the chemist's shop in Perth in his mind, beheld a daily procession of men and women, few of whom were even slightly unwell, coming to demand medicine. He was compelled to prescribe for them. Physic, he had been warned by the doctor whose place he was taking, must in this neighbourhood satisfy both the eye and the palate. It must look and taste "powerful." The doctor had a special "mixture" of his own consisting of

burnt sugar and water, with a pinch of ginger added, which fulfilled the necessary requirements. It " gripped " and enjoyed in consequence a high reputation among the miners. Many of them demanded that Mackenzie should furnish them with bottles of this favourite preparation.

Whether he did so or not, I do not know ; but the " ginger mixture " remained in his mind. It taught him, probably, that a doctor's bottle contains more than drugs and achieves its object by means which are not entirely physical. The chemist's apprentice had not, certainly, realized that very mysterious quality of the products dispensed by him.

Beginning at this time, Mackenzie paid back to his father everything which that good man had spent on his education. This need not be accounted to him specially for righteousness. The majority of Scottish boys of the right type did the same thing at that period.

CHAPTER IV

DR. BRIGGS

MACKENZIE'S opinion of himself had not, as I have tried to show, changed materially since he left school. It bore very little resemblance to the opinion which other people formed about him. The good chemist of Perth had, as has been said, offered to make his ex-apprentice a partner on very easy terms. That offer was followed, four years later, by another from a group of farmers at Scone who desired the young doctor to come and practise among them, and promised him a guaranteed income of £144 a year if he would do so. Again, his application for the post of House Doctor at the Edinburgh Royal Infirmary had been immediately successful, though it was only with the greatest difficulty that he had been persuaded to send it in.

The man who achieved this work of persuasion was Dr. John Brown, a relation of the celebrated Dr. John Brown of Haddington, and also of Dr. Crum Brown, Professor of Chemistry in the University of Edinburgh. Brown had first met Mackenzie in the dissecting room of the medical school where he, Brown, was teaching anatomy. Mackenzie was then a student. Far from regarding his pupil as a dunce, the

teacher took an immediate liking to him and formed, at once, a high opinion of his ability. So much so, indeed, that when, a few years later, he entered practice and found himself in need of an assistant, his thoughts immediately turned to Mackenzie. He wrote to Mackenzie, who was still serving as House Doctor at the Edinburgh Royal Infirmary, and succeeded, again by dint of persuasion, in inducing the young graduate to accept his offer. In the year 1879, Mackenzie came to the town of Burnley in Lancashire to act as assistant in the "firm" of *Dr. William Briggs & Dr. John Brown.*

That step, as has been seen, meant that all hope of shining in his profession had been abandoned. Mackenzie knew very well that general practitioners do not shine. They are the rank and file, the common soldiers of the army of healing. That thought certainly galled him; he was human. But it did not arouse in his heart any spirit of resentment. He assented readily to the proposition that he was unfit for better work. He believed firmly that he was born to play a humble part, and that the qualities of mind necessary to real achievement had been denied him by Providence.

But this knowledge did not weigh unduly on his spirit. The young doctor, when he set out from his native Scotland to cross the border, was a gay fellow enough. If he did not know how to pass examinations, he did know how to play a great—an astonishing—number of games. And he knew also how to be amusing in the company

of his friends, and how to amuse himself when he was alone. He was a very good golfer, and he had tried his hand at boxing, with some success, and other forms of strenuous exercise. He played an admirable game of billiards, and was a good card player and a very good player of chess. Moreover, he was full of interest in books—especially books of adventure and action. He meant to work; but he meant also to enjoy himself, and to live. He was a live man in every fibre of his being.

Burnley, which is a live town, pleased him from the beginning. Its work-soiled streets, filled morning and evening with the click-click of wooden clogs, as men and women went forth to, and returned from, their labour, made vivid contrasts with the quiet ways of his native Perth, or even with the thoroughfares of Edinburgh. Here there was no academic spirit presiding enigmatically over human destinies, but only the strong, sincere spirit of accomplishment. What did it matter how many examinations a man had passed, so long as he showed himself to be a man? In this hard Lancashire air, the very idea that there could be any standard of worth other than the standard of achievement seemed grotesque. Mackenzie knew himself at home.

And at home he assuredly was, in more senses than one. The senior partner of the "firm" to which he had become assistant, Dr. William Briggs, extended a most cordial welcome to the young stranger. Mackenzie was taken into his house, at 68, Bank Parade, and accommodated with a room on the top floor.

This top-floor room was a stroke of good fortune, for Dr. Briggs, and the sister who kept house for him, were people with ideas of their own. They belonged to that period in the evolution of the healing Art in which draughts, wet feet and night air were regarded with apprehension. Dr. Briggs was frankly terrified of draughts, and, indeed, of all forms of air which had not been brought under domestic control. He took great pains to close up the means of ingress of wayward breezes to the spot where he happened to be sitting. He spent much of his life before great fires and behind strong shutters, and he was clothed in wool from head to foot. In spite of these precautions, however, the poor man was a victim of fits of gloom and depression, during which, with some wisdom, he declined to see any patients.

Mackenzie, fresh from Edinburgh, with the new doctrine about germs in his mind, and the new, brave blood of youth in his veins, found the Briggs household somewhat unnerving. Mackenzie had not learned the fear of the night air, nor those other fears which found their expression in mighty four-poster beds, in night-caps, in warming-pans, and in all the grotesque, delicious apparatus of small comforts which our grandfathers and their medical advisers evolved and perfected. Mackenzie actually slept with his windows open, and took cold baths.

A single glance at the faces of Dr. and Miss Briggs must have convinced him, for he was an unerring reader of faces, that the less discourse he held with them about these habits the better he

was likely to fare. He opened his bedroom window with feelings which must have resembled in some sort those of the prophet Daniel, as he flung wide his casement in defiance of the den of lions. The "lions" at No. 68, Bank Parade, Burnley, were accommodated on the floor below, Dr. Briggs having the room immediately under that of his assistant. This, as it turned out, was an awkward complication; for, at the very moment when young Mackenzie felt most eager to leap into his cold tub, good Dr. Briggs was accustomed to complete his period of seclusion from the night air. Dr. Briggs did not permit himself to be wakened till the very last traces of that dangerous vapour had been removed from the earth. To be wakened by the splashings in cold water of a member of his own profession was thus an insult to his common sense, to his knowledge as a physician, to his cherished beliefs, and even to his self-respect.

Nevertheless, it is on record that he was so wakened on more than one occasion. Mackenzie secured a wash-tub, and smuggled it to his upper room. He filled it with cold water. Then, in the morning joy of his heart, he began to splash and puff and blow. These sounds penetrated the substantial floor, the ceiling of the room below, even the curtains of Dr. Briggs' bed. That wise physician heard them.

The young man was warned, first on medical grounds, as an act of common humanity, and then on the ground of household convenience. The noises, he was told, must cease. If, indeed, he

was so destitute of all wisdom as to wish to persist in his bathing, he must bathe, for the future, in silence. Behold him, then, "tubbing" mutely, surreptitiously, with only the twinkles in his eyes to give expression to his feelings, and then, aglow with the laughter he did not dare to emit, descending to his morning's work in the consulting-room.

Even so, his domestic troubles might not be over for the day. Those merry eyes of his did not always find favour with Miss Briggs, and when that lady was annoyed with anything said or done, or left unsaid or undone, she girded herself with silence. Her silences lasted, like winter fogs, for days on end, corresponding, in this respect, to the "glooms" of her brother. They ended, as a rule, at tea-time, at that gracious hour when Dr. Briggs, his brother Mr. Briggs, who also lived in the house, the dispenser, Mr. Holden, and Mackenzie were habitually gathered together. Miss Briggs' tongue would be loosened. It is on record that she usually, as a first step towards reconciliation, asked the young doctor whether or not he had noticed that she had not addressed a word to him for some period of time. It is further on record that the young doctor replied, as a rule, that he had noticed nothing of the sort. This reply, dictated no doubt by experience, had the effect of immediately restoring the lady to her wonted equanimity.

And yet, for all the fuss and folly, Mackenzie was sincerely fond of the Briggs'. To the end of his life he spoke of them with great affection.

For the old doctor's ability as a physician he formed, and retained, the highest possible regard.

And, indeed, there were good grounds for this attitude. Dr. Briggs may have been what Scotsmen call "an auld wife" in his personal habits; in his clinical work he was a very shrewd observer indeed. He knew what Mackenzie used to call in after years, "the face of disease." That is to say, he had built up, in his mind, as a consequence of the teaching he had received from older practitioners and as a direct result of his own experience, a number of subtle and most recondite pictures, each of which represented some form of human affliction. These pictures possessed, for him, a clear and definite meaning. Thus, at the sight of any one of them, the doctor would be ready to express an opinion about the prospects of the patient showing the picture, which opinion, as a rule, was justified by the event.

Knowledge of this sort is spoken of to-day as "the clinical sense," the implication being that it is an inborn gift possessed by very few men. This view was not held in the days when Dr. Briggs went in and out among the people of Burnley. At that time it was realized that "the clinical sense" could be cultivated, and every doctor was at great pains to cultivate it in himself. Assistantships and partnerships in old-established practices were, in consequence, eagerly sought after.

The history of Dr. Briggs' Burnley practice illustrates this in the clearest possible way. When Mackenzie joined it, it was already some

eighty years old, its founder, Dr. Howarth, having set it up at the beginning of the nineteenth century. Dr. Howarth practised from Church Street, Burnley. His successor, Dr. Charles White, moved to Bank Parade. He was killed by a fall from his horse; not, however, before he had taken into partnership a very distinguished student of University College Hospital, London, who had won "the gold medal for the University degree." This was none other than Dr. Briggs himself.

CHAPTER V

THE STORY OF MARY HELM

It was not long before Mackenzie began to interest himself profoundly in the skill of Dr. Briggs. How was the old man able with so much assurance to pronounce one patient "safe" and another patient "in danger"? What did his eyes see which the eyes of a newly fledged graduate of the University of Edinburgh could not see?

The young man, with that caution which was mingled in his nature with impulsiveness, resolved to wait and watch. He soon satisfied himself that Dr. Briggs depended for his "skill" not so much on the detection of those signs and symptoms of disease with which medical schools are concerned, as on the impression conveyed by the patient himself or herself. Dr. Briggs, when he looked at a patient, saw a man or a woman, and not merely a collection of symptoms. As a judge of character may detect the look of guilt in human eyes, or a lover the indefinable expression of affection, so this wise old physician was able to read in the faces of his patients messages of pain, of exhaustion, of weariness and of disease. He came to his knowledge and understanding of illness, indeed, by the way of his knowledge and understanding of his fellow-creatures.

Mackenzie had heard nothing of this kind of "medicine" while at college or at work in the Edinburgh Royal Infirmary. There, the talk was all of disease and of the marks which disease inflicts on its human victims. Everybody—students and teachers alike—had been profoundly interested in these marks; so interested, indeed, that all other considerations, such as, for example, the temperament or disposition of the patient, had seemed of secondary importance. At Edinburgh, the medical world was concerned to discover exactly what was wrong with a sick man; at Burnley, Dr. Briggs, Dr. Brumwell, and the other older practitioners of the town, seemed to think that it was more important to know what was going to happen to him . . . and how to prevent it, supposing that it was evil.

This was a new idea to Mackenzie, and he turned it over and over in his mind with ever-increasing interest. How could one know what was going to happen to a sick man unless one knew what was wrong with him? Surely it was necessary to "take up" the trouble, before attempting to prophesy about it?

And yet Dr. Briggs made prophecies every day, good prophecies, too, without having employed tests or methods of examination which were considered essential in Edinburgh. That could only mean that the outcome of a disease or illness depended on things other than its immediate effect on the patient. Of what nature were these other things?

Mackenzie was now thoroughly interested.

His reason had encountered a problem, and could not relinquish it. But once again he fell back on the explanation which had so often served him in his moments of doubt—the idea that he was a "dunce." No doubt, so he told himself, were he able to understand it, a close connexion between the Edinburgh teaching and the Burnley practice would be apparent. He turned, as usual, from speculation to work, and set himself to do his best for those people whom he was called on to attend.

He was convinced that every ailment could be identified and named, provided that the doctor really knew his job, for so he had been taught. Thus he strove most earnestly to discover the exact nature of the complaints which he met with every day. He studied and re-studied the notes he had taken of the lectures delivered by his professors at Edinburgh. He turned back to his text-books, hoping to find in them some guide to the symptoms which he was meeting, but about which, as he realized, he knew little or nothing. His text-books were full of descriptions of severe diseases, but they had few things to say about the everyday troubles recounted or observed in the consulting-room at Bank Parade or in the houses of the Burnley people. What was he to do? He did not wish to apply to Dr. Briggs for information which that excellent man no doubt supposed him to possess. A new sense of his own deficiencies overwhelmed him.

In his despair, he plunged once again. He bought an enormous encyclopædia of medicine consisting of volumes as big as pillows. Here,

surely, was all wisdom gathered together in one mighty array!

I confess that I have lingered long in contemplation of that amazing spectacle of the young doctor, in his upper room, with his bath-tub and his bulky volumes, attempting to swallow knowledge, as a boa-constrictor swallows its weekly repast; and attempting this tremendous feat, too, in deep humility of spirit, and from the highest possible sense of his duty to his fellows.

Alas! the wisdom of the Encyclopædia was not enough. Not in all these mountains of paper could the answers be found to the questions which agitated the young man's mind. Lest it be thought that I exaggerate on this count, let me quote Mackenzie's own words, written forty years later:

"For some years," he declared, after referring to the Encyclopædia, "I thought that my inability to diagnose my patients' complaints was due to personal defects; but gradually, through consultations and in other ways, I came to recognize that the kind of information I wanted did not exist."

Before anything is said about this discovery, so unexpected, so overwhelming in its consequences, a fact of a more material kind must be recounted. At the end of a year's work, the assistant to the firm of Briggs & Brown was offered a third share in the practice. He accepted the offer, and moved from his top-floor room at No. 68, Bank Parade, to No. 64, Bank Parade—Dr. Brown, the surgeon of the firm, being already in

residence at No. 66. Thereafter a reorganization of the methods of the firm was carried out, and a system of book-keeping and note-taking introduced, which has remained in use in the practice ever since. Drs. Briggs, Brown and Mackenzie arranged their work in districts. Morning consultations were introduced, and these were followed by the day's visits, which were completed, as a rule, by one o'clock. From two until four o'clock, one of the partners conducted "afternoon surgery," and this partner remained on duty as "emergency officer" all that day. Thus there were hours of leisure, as well as hours of work. Mackenzie employed some of his leisure writing a second novel.

He completed only two or three chapters of this book. Yet that fragment possesses interest because of the light it casts on his powers of observation, and on his human sympathy. The scene of the novel was Burnley, and the characters the humble folk among whom, and for whom, he worked. In every line he has managed to convey the impression of complete sincerity. Here is, as it were, a first leaf taken from the book of good Dr. Briggs, a first attempt to see disease and distress as phenomena of life—that is, to see them in their authentic setting. The heroine of the novel is thus introduced :

"Of these tired and feeble workers, whose weary footsteps trailed among the last, was Mary Helm. Over her head was thrown the usual shawl, faded now from what it was when, in the

heyday of youth, she had bought it for its attractive colour. In her hand she carried the tin can and handkerchief which, in the early morning, had held the food that was the day's spare meals. . . . She made her way into the lowest and poorest part of the town. Calling at a neighbour's house for her four children, and the key of her own door, she hastily unlocked the door, and at once began to kindle a fire and then made preparations for the evening meal. The day's task was far from finished for her, for she had now to resume work in a household of unmanageable children. . . ."

When the meal was made ready, Sam Helm, Mary's husband, appeared to eat it.

" A rasher of bacon and some tea were placed before the father, while mugs of tea and chunks of bread were given to the ravenous children. Mary herself ate but little—a thin slice of bread (she could not afford butter), and a cup of tea. Too tired and feeble to relish substantial food, she took that which refreshed and, in a manner, comforted her."

Let me invite the reader of this biography to picture the coming of such a woman to the consulting-room at Bank Parade, and then to make a further picture of her reception there by the young Mackenzie. In his pity for her, in his knowledge of the hopelessness of her position, there must have come to his mind, as in a flash of revelation, the truth that disease can never be known or understood apart from those afflicted by it. The ailments of a Mary Helm, for example,

might resemble those of a rich man's wife, so far as their actual nature was concerned; but the outlook for the two women, if stricken by the same malady, must be wholly different. Not only so, but, even in Mary Helm's own family, there were strong members and weak ones; a child with the vitality necessary to a successful resistance to disease, another child so feeble that even the mother herself could see that its life must soon come to an end. Let me quote from the story once more:

"At this moment, the door opened and her mother and sister entered.

"'Oh, mummy,' Alice cried, 'Johnnie is having such a nice sleep.'

"A smile lit up Mary Helm's wan face. She went softly to the cradle. Stooping over it, she gazed at the child. . . . A great fear seized her. She lifted the child, and clutched it in her arms. A cry broke from her lips.

"'My Johnnie's dead. . . . My Johnnie's dead.' A violent outburst of weeping followed.

"The children looked frightened and scared in the presence of the woman's passionate sorrow. . . .

"Two kind-hearted neighbours went into Mrs. Helm's house. They found the poor woman hugging the dead child with hysterical violence. They gently persuaded her to give up the child, and then took it and performed tenderly the necessary little offices. Then they helped to prepare the evening meal, and withdrew, leaving the mother gazing with tear-stained face into the fire. . . ."

CHAPTER VI

THE METHOD OF "WAIT AND SEE"

It took Mackenzie a long time to recover from the disappointment of the Encyclopædia. Here was a vast storehouse of knowledge, warranted to contain enlightenment in every branch, on every twig, of the science or the art of medicine. Yet the very simplest questions—questions which seemed to the young doctor absolutely fundamental—were not so much as mentioned.

What Mackenzie wanted to know was the meaning of the signs and symptoms he met with every day. And by "meaning" he intended meaning in relation to the patients' future safety, and not merely meaning in a scientific sense. For example, if he were dealing with a pain in the chest, he was more concerned to know whether or not this betokened tragedy for his patient, unless subjected to proper treatment, than to know whether or not the heart itself, or one of the great blood-vessels flowing out of the heart, or the lung, was the seat of disease. Not that he underestimated the value of this last kind of knowledge. His whole life stands as the answer to those who suggest that medical research did not interest him for its own sake. But the practical side of

this subject was so tremendously urgent. Almost every day some man or some woman appealed to him in sore anxiety and distress, to say just what his or her trouble meant, and to ask how it might be cured. He felt that he must be able to answer these questions; that until he was able to answer them, he had no right to call himself a doctor.

These questions, indeed—the questions, spoken or unspoken, of every sick person who turns to a professional man for help—challenged Mackenzie's very soul. They appealed directly to the simplicity and honesty of the man, to his natural kindness of heart, to his desire to serve his fellows, to his sense of fair play. Patients, he felt, were entitled to ask for a verdict; they were entitled to expect that the doctor they consulted should be able to satisfy them. Indeed, the need of such satisfaction was often very urgent—when, for example, the bread-winner of a family became aware of some symptom which seemed to threaten his earning power. Further, they were entitled to demand that a doctor should be able to foresee danger, and so to prevent it.

Yet, in spite of the urgent need, in spite of his own eagerness, Mackenzie knew that he lacked the information which might enable him to prophesy with a reasonable degree of certainty. When asked what was likely to happen in a given case, he was forced to adopt the tentative attitude of the man who is not sure—for he put away from him the temptation to make statements in advance of his knowledge. That attitude, as he fully realized, is a disastrous one from the point of view of the

patient, since it gives rise to all manner of anxieties.

A friend of the late Henry James, the novelist, told me a story of Mackenzie, which shows how very keenly alive he was to this consideration. Henry James had suffered from a pain, and desired to consult Mackenzie about it. When he entered the doctor's room in Harley Street, he was met with the question:

"What was it really that the children saw outside the window which so greatly terrified them?"

The reference was, of course, to a story by James himself. James raised his hands, and in that voice of his which, had it not been sincere, must have been almost incredibly pompous, replied:

"My dear Sir James, do you not know that the whole basis of terror is mystery? The children were afraid, because they did not know what it was they were looking at. Why, then, should I tell the reader what they were looking at?"

Mackenzie nodded, and proceeded to examine his patient. Then he asked:

"Of what are you afraid?"

"I don't know. . . ."

"Like the children in the story."

James saw the point, and went away comforted.

The immediate problem in the year 1883 was how to probe the mystery of the unknown, how to find out what each symptom betokened not only in the present, but also for the future. For a long time the young doctor could think of no way

of achieving his purpose. Then one day the truth dawned on his mind.

The only way to find out what a symptom betokened was to wait and see what happened to the person with the symptom.

That meant an investigation lasting about twenty years. His spirits were cast down at the prospect, until another idea occurred to him—that every doctor, unconsciously, makes such an investigation. The mysterious power possessed by Dr. Briggs, of knowing what was going to happen to his patients, was neither more nor less than *accumulated experience.* Dr. Briggs had been so long in practice that he had, in fact, waited and seen on countless occasions. Each time that he looked at a new case he saw, in reality, hundreds of old cases, and remembered how they had fared.

Unhappily, Dr. Briggs was quite unable to impart or hand on his secret. He didn't know how he knew. His experience was entirely personal to himself. Mackenzie realized, after a time, that this state of mind was not peculiar to his senior partner. It was common to the vast majority of practitioners. He saw that if knowledge, which could be passed on to new generations, was to be gained, the "Wait and See" method must be pursued deliberately and consciously. Further, it must be pursued in the fashion adopted, instinctively, by every good doctor. In other words, his sharp eyes probed the secret of successful practice, and so discovered a method of research peculiarly well suited to the science of medicine,

a method which had, indeed, been in use, unconsciously, by doctors for centuries. He resolved to set about applying his method.

He has left an account of his state of mind at this time—an account which, I confess, I never read without recalling passages from the diary of *Robinson Crusoe*. Mackenzie's style was rugged, but it had the grand simplicity with which Defoe managed to endow his hero. This man, like Crusoe, was forced to shape his own tools, to begin at the very beginning of things, to build his world by the labour of his two hands.

"About 1883 or 1884," Mackenzie wrote, "I resolved to begin a series of careful observations entirely for my own improvement, never dreaming of research, for I was under the prevalent belief that medical research could only be undertaken in a laboratory or, at least, in an hospital with all the appurtenances. I merely sought to find out something about the nature of my patients' complaints. I had recognized that when the patients had some physical sign, and when disease had made considerable ravages in the body, a moderately accurate diagnosis could be made; but in the vast majority of my patients there was no physical sign, or, if there was a physical sign, I was not sure of its relationship to the patient's ill-health.

"The ill-health was chiefly recognized because of the patient's consciousness that he was not well, and this was made known to him by his own sensations. Sometimes these sensations were accompanied by phenomena of a certain kind, such as increased pulse rate, a rise in temperature, or a

slight pallor. . . . I put to myself the question, 'What is the mechanism by which these symptoms and signs are produced?' And to my astonishment I found that nowhere in literature could be found a satisfactory explanation of the mechanism of a single one of them.

"So I set before myself the task of finding out the nature of the symptoms and signs which I met in the course of my practice.

"At the same time, I resolved to seek an answer to another question which had baffled me. This was to tell what was the progress of the patient's complaint. I recognized that practically every patient who consulted me wanted to know, not what ailed him, but what was to be the outcome of his complaint. I had occasion, in my daily work, to examine men for life insurance, and for their fitness to join their clubs. I filled up their certificates, giving my opinion upon their prospects, but when I came to ask myself on what grounds I had penalized this individual and rejected that one, I found I had no real knowledge. I was merely guessing.

"I had thus placed before me two definite objects, at which to aim: (1) understanding of the mechanism of symptoms, and (2) understanding of their prognostic significance. When at this date, forty years after, I look back upon my work, I can recognize that it was this simple resolution and these definite aims which guided me to such success as I have achieved. . . . I may point out that the necessity for such an investigation, with these aims, could only be found necessary by one who had, in his daily work, found the need for them."

CHAPTER VII

THE BEGINNING OF THE QUEST

Behold, then, the young pioneer setting forth on his great adventure. He thinks, honestly, that he is merely labouring "for my own improvement"; in fact, he is about to challenge the "giants" of his profession. The stripling, David, with his pouch of pebbles, came not more daringly against Goliath.

Mackenzie's "pebbles" were tiny enough to set the ranks of the Philistines in a roar of mirth; and, in fact, the Philistines, as we shall see, laughed long and loud when, at last, the truth dawned on them that this country doctor was actually calling them and their chosen champions to battle. Perhaps Mackenzie's chief weakness at this time was still his lack of assurance in his own power. He was absurdly modest for a man who was going giant-killing. He still believed himself a dunce: he still thought that wisdom resided with his teachers, and more successful fellow-students. Not for a moment did he dream of claiming a higher status than that of the humble general practitioner of the small town.

Moreover, though he knew what he wanted to find, he did not know any better way of finding it

than waiting for twenty years! Such a proposition recalled to ribald critics the story of the man who trained his horse to live without food, and was distressed because, just when the animal had acquired this useful knowledge it died. Who, at the bidding of a general practitioner who had been a dunce at college, was going to wait twenty years for information which, in any case, nobody wanted?

Mackenzie girded his loins and ate his Passover. That dogged will which had carried him through his years of apprenticeship in Perth, and which had brought him to the class-rooms of Edinburgh University, was exerted to compass the new task. The young doctor set to work to make a note, a full note, of every single symptom presented by every patient who came before him.

As well try to empty the Atlantic with a tea-cup!

Within a short time of setting forth, failure stared him in the face. He realized that it was impossible to carry out his plan, even though he should labour night and day to that end. There were too many symptoms to be recorded. With great reluctance he decided to limit his work to certain groups of symptoms.

CHAPTER VIII

OUT OF THE DEPTHS

THERE are awful moments in the life of every doctor—moments when courage and confidence and even faith are shaken to their foundations. Such a moment was approaching for Mackenzie.

He was summoned one night to help a young woman in the pains of childbirth. She was a patient of his own, a girl whom he had visited during the period of her expectancy, and whom he had then examined. The case promised to be easy and uneventful.

There is a sameness about all birth-scenes, no matter in what setting they are enacted. Let the reader imagine a room warm above the average, and cosy with screens set over against the cheerful fire. Let him picture the anxious faces of old women, as a rule a midwife and a near relative of the young mother, and the less anxious but alert and eager face of the doctor. Let him see the prostrate figure on the bed, a poor little figure of sorrow, alone in that struggle with most monstrous pain.

The doctor is seated beside his patient, so that, from time to time, he may feel her pulse, and so

that he may render all the help in his power at each stage of the conflict. . . .

* * * * *

"Oh, doctor, I can't stand any more! . . . please, doctor. . . ."

"There, there, be a patient girl. It will soon be over."

* * * * *

A great silence falls in the room. The girl's hair is wet with perspiration; beads of perspiration gleam on her brow. The blood rushes in full tide to her cheeks, as the last exertion of her pain fades away; her eyes glow splendidly in the lamplight. The doctor bends over her and wipes her brow, supporting her with fresh assurances and encouragements. . . .

There comes a gentle knock at the door of the room. The girl's mother, whose old scarred face is full of apprehension, rises and opens the door. Then she signals to the doctor, who immediately joins her. It is the husband, who has come to ask if the ordeal will soon be ended.

"Yes, very soon."

"Is she all right, doctor?"

"Splendid."

"Thank God for that!"

The good fellow goes away comforted. The doctor returns to his post by the bedside.

"Was that John?"

"Yes. He's worrying about you."

"Poor old John!"

Again the silence possesses them . . . that strange, deep silence in which human souls arrive

into this world, and in which also, as a rule, they depart from it. The doctor's mind, perhaps, is filled once again with the wonder which has so often filled it when he has seen the kindness and lovely courage of women during these supreme hours. . . .

The girl's hand tightens its grip on his wrist, so that his thoughts are summoned sharply back to his duty. A dusky hue overspreads the glowing face beside him. A new instalment of the price of motherhood is about to be paid. . . .

Suddenly the doctor starts from his chair. All the blood has run away from his cheeks. A wild fear shudders in his eyes. . . .

He seizes the girl, and lifts her in his arms. His hands are set on her heart, as though he would compel it by main force to resume its work. . . . He pauses, like a creature distraught, and glances down at the fair young face. There is no colour in it now, and the long eyelashes fall in exquisite tranquillity on the cheeks.

"O God, can it be possible? . . ."

He clutches at the wrists to feel the pulse. . . . He turns his face to the women, who, as yet, seem to be unaware of the calamity which has befallen. The expression in his eyes makes them cry out in chill and awful dismay. . . .

"The brandy . . . hot water . . . a towel dipped in hot water. . . . Oh, be quick, be quick! . . ."

* * * * *

The girl was dead. She had died of sudden heart failure. Her child remained unborn in her

womb. James Mackenzie, as he turned to break the news of her death to her husband, tasted the bitterest anguish which any doctor can ever experience.

* * * * *

An hour later, in his consulting-room, as he paced the floor in the deep silence of the small hours, the full horror of this calamity was revealed to him. The question sprang to his lips, "Would this death have occurred if I had had a better knowledge of heart afflictions?" In other words, had there been present, before the time of delivery, signs or symptoms which might, had he recognized them, have served as warnings to him, and so have enabled him to take precautions?

He could not answer these questions, and the fact of his ignorance appalled him. He felt a sense of guilt, which chilled his very soul. There and then, beside that infinitely piteous deathbed, he resolved to obtain a better knowledge, and to make a beginning by studying, in women, the mechanism and history of the symptoms usually supposed to indicate heart trouble.

It was thus that Mackenzie became a heart specialist.

CHAPTER IX

THE RIDDLE OF THE WAVES

He lost not a day in beginning his new work—for were there not other cases of childbirth due to occur? The available literature of the subject was ransacked . . . without avail. Then, in despair, the general practitioner himself became a research worker. He records:

"I studied the circulatory condition of women before pregnancy, watched them carefully during the time they were pregnant, observed them closely during labour and the puerperum" (the time immediately following childbirth), "and for months and years after. I studied not only cases with damaged hearts, but also many healthy women. After several years I had collected a large mass of material. I found, among other things, changes in the size and position of the heart, murmurs of different kinds, variations in rate and rhythm and other departures from what is usually considered the normal."

These discoveries challenged him; he durst not refuse the challenge. Thus, in spite of himself, even, in a sense, against his will, he began to specialize. He had aimed at a study of every symptom of disease; the natural weakness of

humanity compelled him to limit that effort to a few symptoms. A tragic accident determined that these few symptoms should be associated with one particular organ. Yet—for such is the power of accident in the shaping of human destiny—when, in days to come, he was labouring to tell the world about his great study of symptoms, the world refused to think of him as other than a "heart specialist." When he cried, almost in despair, that his work on the heart was merely one illustration of a principle which must be applied universally, he was met by the bland assurance that his researches "on the subject of heart disease" had added to knowledge "of this group of ailments." There have been few more comic—in the Greek sense of that word—episodes in the history of medicine than this one of the man who didn't want to be a "Great Heart Specialist," who tried his very hardest to shun and avoid that title, yet who was pursued by it through years and years, and finally by it overtaken. How "the little devils of mirth"—in Meredith's phrase—must have held their sides at the spectacle!

Yet "the little devils of mirth," who are reputed a kindly folk, must have mingled with their laughter deeper notes of joy and happiness. For this dire accident, which created Mackenzie a "great heart-specialist," though it served him ill in one direction, served him well enough in another. The world, and especially the medical world, loves an expert. The world, and especially the medical world, would not have listened so respectfully as it did listen, had not its attention

been directed to the study of a single organ what time its ears were charmed by the sound of the word "Cardiologist."

The elector who interrupted a North-Country political meeting with the remark, "Don't keep harping on the vote; it's the franchise we want to hear about," was surely a profound student of human nature.

One of the most frequent abnormal signs in pregnant women was, the young investigator soon discovered, irregularity in the action of the heart. Instead of beating in a steady rhythm, that organ seemed, often, to trip or stumble in its paces. The pulse, which is a throb occurring in all the arteries of the body when the heart beats, was always, of course, irregular when the heart was irregular.

Were these irregularities of the pulses of expectant mothers signs of danger? Mackenzie, still greatly alarmed and saddened by his terrible experience, began at once to search for an answer to this question. Again he ransacked the libraries in the quest and, throwing all personal pride to the winds, besought his professional colleagues and friends for information. Both the books and the doctors were vague in their replies, but the suggestion was conveyed that they regarded the irregular pulse as certainly a bad sign. In one of the books it was even recorded of a young mother that "her heart became irregular, and she sank and died."

Meanwhile, in his own practice, some of the women with irregular hearts bore their children easily and safely. He realized that there must be

dangerous types of irregularity and also types which are not dangerous; but how was he to distinguish the one type from the other? He resolved to "write the pulses" of a large number of women, and then to study the writings with the closest possible attention.

This was not a difficult matter, because there was on the market a clever little instrument called, after its inventor, the Dudgeon Sphygmograph or Pulse Writer. This instrument is constructed on the principle that a very small throb or tap can be made use of to move a light needle with considerable vigour, if the needle is properly balanced and pivoted. Each throb of the pulse is made to "hit" a spring which, in turn, sets a needle oscillating, and this needle "writes" on a piece of smooth, smoked paper on which it traces fine white lines. The tracings, that is to say, the pieces of smoked paper which have been passed through the sphygmograph, are afterwards varnished to prevent the soot—and with it, of course, the tracing—from being rubbed off.

His sphygmograph soon showed Mackenzie that his idea that there were several different kinds of irregularity of the heart was correct. He amassed an immense number of tracings . . . those short, neat tracings which the "Dudgeon" produces. He pored over them at night, comparing them with one another. In one he could see that the beats, represented as a series of waves, were large and long, like Atlantic rollers; in another, that they were small and short; in yet

another, that they broke from one wave-rhythm into another as when the surface of the sea is agitated by wanton winds. And even these variations did not exhaust the vast and intricate complexity of the waves. For sometimes a larger wave would seem to bear a smaller one on its bosom; and this would be followed by a pause, as though the heart had ceased to beat. Then a great sweeping roller would come to show that lost time had been fully regained.

What did all these different kinds of waves mean? Which were the dangerous ones, and which the safe?

There was no answer. The young doctor despaired among his varnished tracings, which lay around him like hieroglyphics of which the key has been lost for ever. If only he could read this secret cypher of the heart!

He could not read it. He turned from his tracings to Nature, to the men and women whom he served, and once again brought his powers of observation to bear on them. Then he noticed that many pregnant women, and many sick folk of both sexes, had pulsating or throbbing veins in their necks. In some cases these veins beat or fluttered like the wings of a bird. In other cases, long heavy throbs agitated them. In still other cases, there was no throbbing at all. Was it possible that a study of this sign might cast light on the mystery of the manifold waves of the pulse?

He did not feel very hopeful, for he had already, in his timid Edinburgh days, interested himself

in the throbbings of neck-veins, only to be assured by superior authority that such manifestations were of no consequence.

"The veins," he had been told, "flow down to the heart, carrying to that organ the dirty blood from the body. Their throbbings are merely a 'backwash' from the heart, each beat of which flings a little blood backwards and so, for a second, bulges the veins."

It sounded reasonable enough, plausible enough. Mackenzie, who at that period venerated authority deeply, dismissed the throbbing veins from his mind.

But now, with the sense of his own ignorance and helplessness weighing down his spirit, he was less disposed to relinquish any clue which might lead him to the knowledge which he so eagerly desired. The throbbings might be "only a backwash from the heart," but, even so, he intended to investigate them.

Another disappointment awaited him. These beatings of the neck-veins were not less varied, not less bewildering, than the waves of the pulse. Indeed, they were more varied and more bewildering. When he tried to make use of them as a sign of the state of the heart, he realized that they were quite useless. Fit, healthy people sometimes showed pulsations exactly similar to those revealed by men and women suffering from severe weakness, or even coming by swift steps to the gates of death.

Then the idea occurred that, perhaps, if tracings or writings of the pulsating veins could be made,

new light might be obtained. The young doctor puzzled his brain to know how to procure such tracings. It is one thing to strap a "Dudgeon" pulse-writer on to the wrist, and set it running. The "pulse" is very conveniently situated for such work. It is another thing to try to catch the throbbings of blood-vessels in the neck. After a great many failures, he hit on the idea of fixing straws on the neck with a little gum. The straws were so light that they moved with each throb of the veins, and this movement could be transferred to the pieces of smoked paper by allowing each straw to act as a pen, that is to say, by moving the strip of paper slowly under the point of the straw.

It was a crude attempt, but a sort of tracing was obtained. Mackenzie had proved that the beatings of the neck-veins were capable of being recorded. He meant to record that beating, so that its secret should be plucked from it.

He was tremendously busy at the time, full of work, laden with the anxieties which every doctor is compelled to bear day after day. Moreover, a very great event, the greatest that can occur in the life of any man, was toward. The young doctor, in the middle of his strenuous living and strenuous working, had fallen in love.

CHAPTER X

HIS WIFE

MACKENZIE was a splendid-looking man, tall, broad shouldered, with massive brows and the clear, masterful features of physical and mental strength. Courage radiated from his eyes. And not courage only: humour and kindness also, and a native gentleness of disposition which was in keeping with his robust vigour. This man was incapable of being "small," even to the extent of being petulant; but he was exquisitely simple, as simple as a child.

I suppose that this quality must seem to women even more lovely and attractive than it seems to men, for the life of woman is bounded about by elemental things, and her interest focusses naturally on those who express them. Moreover, there is in the child-heart a sunny and infectious joyfulness which is childhood's immemorial appeal to women. I think that, as a young man, James Mackenzie must have been extraordinarily attractive and inspiring. I am quite sure, however, that he never realized the fact. There are a very few men in this world who are by nature humble, and whose humility extends to all the relationships of their lives.

Such men are made or marred by the women

they marry. Selfishness in the wife to whom they have given themselves withers them, because invariably they blame their own unworthiness rather than hers, and are cast down utterly in the contemplation of it. But love clothes them with strength. It is renewed in their spirits, day by day, down the procession of the years, so that, when other men have forgotten love, or remember it only as a dream of youth, their love informs and animates their spirits, burning with an ever-brightening flame. So it was with this man.

There is pleasure in the thought that it was a child who first introduced him to his wife. In the year 1887, Miss Frances Bellamy Jackson had come to Burnley to be governess to four little girls whose father was the head of a large colliery concern. The family were patients of Dr. Mackenzie, and when, early in 1887, one of the girls seemed unwell, he was called in. As it happened, the children's mother was absent from home, and so Miss Jackson had to interview the doctor. He speedily reassured her about his small patient. He did more than that; he convinced her that he was really fond of the child. It was a short and merry interview.

Very soon after that, Miss Jackson was Dr. Mackenzie's partner at a dinner-party. She fell in love with him there and then, and he with her. They met once or twice. They carried on a "lively correspondence," after the manner of the times. They became engaged. Romance had once more claimed her son.

How his spirit must have exulted in these

days, as he went forth diligently to his work and returned to varnish his pulse tracings! And what dreams did he not mingle with that shining varnish—dreams sweeter and more abiding than the visions with which he had delighted his eyes in the old days in the woods at Scone, when he beheld the gentle knights and their ladies go riding by! The tracings, however, had more of his time, throughout his betrothal, than his lady. During all this period he saw Miss Jackson only once a week, on Sundays. On that day he was always invited to the house where she was still carrying on her work as governess.

* * * * *

A man's marriage, as I have said, influences his whole life either for good or for evil. Mackenzie's life is the true measure of his marriage; his achievement, as he told me himself on several occasions, belongs to his partner as much as to himself.

"She is everything to me . . . everything. We shared it all from the very beginning."

And no man who heard him speak thus ever doubted his sincerity. On the contrary, all men who knew him, knew his happiness also. It was so great, that it seemed to echo in all his laughter and to be woven into the very texture of his spirit.

While I was writing this book, I wrote to Lady Mackenzie, and asked her to tell me a very little about her married life. She replied:

"No woman ever had such a generous love and companionship given her."

* * * * *

The marriage took place at the Parish Church of Shottermill, near Haslemere, on September 13, 1887. Sir William Mackenzie, Sir James's very distinguished brother, was best man. The honeymoon was spent in Italy.

And then the young doctor—he was thirty-four years of age—and his bride returned to Burnley, and the varnished tracings.

CHAPTER XI

THE KEY OF THE CYPHER

THE challenge of the tracings remained; the riddle of the waves. But the young doctor had now a new idea in his mind. He put away the straws with which he had been working, and tried, instead, a small funnel held over the throbbing veins. This funnel was connected with a rubber tube, which, again, was connected with a rubber ball. The idea was that, each time the veins throbbed, the throb would cause the thin rubber of the ball to swell out a little.

And so it happened. But the joy of the inventor was dimmed a little when, suddenly, he remembered that, during his college days, he had seen just such a piece of apparatus. Somebody else had evidently been working on this problem before. He made inquiries, and found that he had actually re-invented a famous device in everyday use in physiological laboratories, the so-called Marey's Tambour. The principle of this tambour is that if a rubber ball is pinched or pressed on one side, it bulges on the other side. Again, if two rubber balls are connected together by a piece of tubing, and one of them is pressed upon, the other one will swell up. Mackenzie

rigged his tambours to his Dudgeon's pulse-writer, and so managed to get the throbbings of the neck-veins transferred to paper in a really effective way. This was an immense improvement on the tracings he had obtained by means of his gummed straws.

But, as he put it himself, "the difficulty lay in interpreting the waves." He possessed exact pen-pictures of dozens of these throbbings; but, like the waves of the pulses which he had taken before he began to be interested in the neck-waves, they baffled rather than enlightened him. No secret code was ever more inscrutable; no cypher more difficult to read.

As usual, he applied to authority; that is to say, to the "giants" of his profession, for help.

"I remember," he wrote, "carrying about a tracing and asking physiologists to interpret it for me. Finding no one who understood it, I resolved to try myself."

The first question which had to be answered was this: Who or what was the "writer" of the secret code? What structure or organ of the body was it which occasioned and produced those throbbings in the blood-vessels of the neck? The answer, obviously, was—*the heart*. That organ, and that organ alone, is the cause of pulsations in blood-vessels. Very well, then; how came it about that the heart produced three waves—for there were three waves in the neck tracings—closely following each other?

Mackenzie could not understand these three waves. In the pulse, at the wrist, there is only

one wave corresponding to the beat of the heart. How came it about that this one wave was multiplied three times when the blood-vessels of the neck were concerned ?

He racked his brain for an answer, and found none. Then his mind returned to the point from which it had started : seeing that the heart was the sole begetter of these three waves, he must set about finding out what the heart was doing at the instant at which each one of them was begotten.

He turned his attention to a plan for making simultaneous writings, or tracings, of the heart-beat (as it occurs on the left side of the chest) and of the neck-throbbings. The three waves should be set side by side, so to speak, with their author. In order to accomplish this purpose, he visited the haunts of the " giants," and secured one of their special pieces of apparatus, the kind of thing which, until this hour, had never so much as been seen outside of a physiological laboratory.

By all accounts, it was a fearsome-looking contraption. There was a large brass drum which could be made to revolve slowly by clockwork. Upon this drum, so as to surround it completely, pieces of smoked paper were stretched. Then a number of " pens," supported on a stand, were set writing on the surface of the smoked paper. Each pen had a tambour (or rubber ball) attached to it, in such a way that, when the tambour expanded, the pen moved upwards on the paper. Thus any beating or throbbing, which could be communicated to the tambours, set the pens writing.

Mackenzie managed to communicate the three waves of the neck-throbbings to one pen, and the beating of the heart itself to another. Thus, while his patient lay at ease on a bed with the little funnels, which communicated with the tambours, held in position, the one on the neck and the other on the heart, the busy "pens" behind the tambours wrote down their messages on the smoked paper of the revolving drum.

And thus the mystery of the three waves was resolved. They were made, indeed, by the heart. But they were not all made by the same part or "chamber" of that organ. Let the reader remember that the heart is not simply a bag, but is a most beautifully fashioned structure containing four separate chambers, each of which has its own special office to perform.

"The blood," as the scriptural writer declared, "is the life." It corresponds to the transport system of a community whereby food is brought to each household, and dust and refuse carried away. The heart, which pumps the blood, sends nourishment to every cell and particle of the body and removes from every cell its waste matter and *débris*. This organ, therefore, is, in a sense, the universal provider.

If we follow the stream of blood in, say, one of the veins, we find that it flows towards the heart. The small veins join each other to form larger veins, just as small streams are formed, by their union, into great rivers. The larger veins, again, unite to make up the great "trunks" or *venæ cavæ*, which bring the blood, finally, to the heart.

The blood enters the upper chamber of the heart, situated on the right side of the organ. This chamber is called the Right Auricle. As soon as the right auricle has become full, it beats; that is to say, it shuts just as the palm of the hand shuts. This shutting action squirts or drives the blood out of it into the lower chamber on the right side, called the Right Ventricle. Thus, it is the business of the auricle to collect blood and then drive it down into the ventricle. The business of the ventricle is to squirt or drive the blood away from the heart.

When the Right Ventricle, or lower chamber, is full, it shuts and sends its contents directly into the lungs. Here the blood comes into contact with the air which we breathe, and is freshly charged with oxygen and so cleansed. The blood, having flowed through the lungs, comes back to the heart, and enters the upper chamber on the left side of the organ, the Left Auricle. This, in its turn, beats or shuts, and drives its contents into the lower chamber on the left side, the Left Ventricle. The left ventricle, when it beats, drives the blood all over the body, from the soles of the feet to the crown of the head.

When Mackenzie looked at his double tracing, in which were shown the three waves of the neck-throbbings and the actual beatings of the heart, he perceived that the actual heart-beat corresponded to the second or middle wave. Now, the heart-beat, as it can be seen and felt on the left side of the chest, is made by the lower chamber on the left side, that is to say, by the Left Ventricle.

It is this chamber which, as we have seen, drives the blood all over the body. It is this chamber, therefore, which makes the ordinary wrist pulse. Thus, the young doctor could say that a part of the neck-throbbing—one of the three waves—was due to the ordinary "pulse wave," which runs along every artery each time the heart beats. He knew that, close beside the great veins of the neck, the Jugular Veins, lie the great arteries, the Carotid Arteries. Wave No. 2, without doubt, was the Carotid Pulse, or pulse wave in the carotid artery.

What of Wave No. 1? That, as could be seen from the tracing, occurred a fraction of a second before the actual heart-beat—before, that is to say, the beat (or shutting) of the Left Ventricle. Mackenzie saw that it must, almost certainly, correspond, in time, to the beating of the auricles. These chambers, Right and Left, beat, as has been said, before the Ventricles, in order to fill them. Naturally, when the Right Auricle, that is, the right upper chamber of the heart, begins to beat, the flow of blood into it from the veins is stopped for the moment. The veins become slightly bulged, just as the stream which has been dammed tends to rise between its banks.

Wave No. 1, then, was caused by the beating of the Right Auricle of the heart, which occasioned a bulging or throbbing of the Jugular Vein in the neck; Wave No. 2 was caused by the beating of the Left Ventricle of the heart, which occasioned a throbbing of the Carotid Artery in the neck.

The nature of Wave No. 3 remained obscure,

but that fact did not diminish the thrill of delight which the young doctor felt.

He had actually discovered a method of finding out not merely how the heart as a whole was beating, *but how two separate chambers of the heart were beating.*

It is small wonder that he carried his bulky apparatus, drum and tambours and pens and smoked paper, all over the countryside with him in his carriage, to any patient who might seem to show signs of heart weakness. His drum and tambours speedily acquired great fame, and people told each other tales of the setting up of the mystery machine in remote cottages, and of the " smoking " of the strips of paper in the fumes of burning camphor. Such marvels had never before been known, or even heard of.

The public mind, as Mackenzie was soon to discover, is fatally attracted by marvels.

CHAPTER XII

"MANY INVENTIONS"

I SHOULD like my reader to fix his or her attention on these revolving drums and tambours of Mackenzie's first polygraph. Here, truly, was a fine piece of mystery; the sort of thing to set tongues wagging—the sort of thing which, from one generation to another, has filled up the consulting rooms of inferior men with unthinking patients.

Watch the drum as it revolves slowly, what time the pens, like the sensitive antennæ of some monstrous insect, trace their white lines on the smoky surface of the paper. Or, again, watch the doctor as he "smokes" his paper over the burning camphor, like some priest of ancient cult performing a strange rite. What would not the "worse end" of Harley Street have given for this "business"?

And then observe, as a contrast to the wonder and delight of the patient, the exasperation which haunts the physician's eyes. Mackenzie hated "that old drum" for its slowness, for its size, for its weight . . . for those very qualities which must inevitably have endeared it to some other minds. He hated it for the time it wasted in getting to

work; for the clumsiness of its achievement, for the cheap mystery which it engendered. "So I was driven to devise a more useful instrument." This new instrument, he determined, should be simple, easy to use and easy to carry about. It should record, in addition to the throbbings of the vessels in the neck, the pulse-beat at the wrist, which, as has been pointed out, corresponds to the actual heart-beat or beat of the Left Ventricle of the heart.

"It occurred to me," Mackenzie wrote, "that the radial (wrist) pulse would make an excellent standard, so I made a tambour out of a pill-box, and fixed a handle to it of copper wire, and tied this to the upright stem of a Dudgeon Sphygmograph. After a little manipulation, I found it to work excellently, and from the crude model *I got a very serviceable instrument made, which I could carry about in my pocket.* By substituting for the rigid band, which fixes the sphygmograph to the wrist, an elastic band which I tied in a knot, the instrument could be very rapidly fixed. So easy was this, after a little practice, that I would take a tracing . . . while the temperature was being taken, *so that it was not time-robbing.*"

Observe: a pocket instrument which should not be time-robbing! An unmysterious instrument!

"This instrument," he records elsewhere, "I used for a great many years, and I look back upon it with a great deal of affection. It was both accurate and serviceable, and, though it has been replaced by the ink polygraph and the electrocardiograph, neither of these instruments is so

adapted *for general use*. . . . Very few physicians at this day realize what important observations can be made with a simple instrument which, because of its simplicity, has been derided as a toy, or ignored."

Mackenzie was busy, a man with work to do; a man who believed in his work, and who wished to achieve it with the greatest possible diligence and care, and the least possible humbug or waste of time. As time passed and he found that the symptoms he had discovered with his various instruments were detectable also by the finger of the physician, he put his instruments away. At a moment, as will be seen later, when the "scientific" world was making obeisance before that new god, the Electrocardiograph, the man whose work had opened the way for the coming of this instrument, was using no other device to detect irregularities of the pulse than his own finger. He wrote in fine scorn:

"I was not surprised that my researches into prognosis (the art of foretelling danger) found little countenance in the profession. While my methods of taking records (tracings) appealed to a great many people, the principles for which I used these records were completely ignored or misunderstood. I discovered that the seeming exactness of a mechanical device appeals much more strongly to certain minds than a process of reasoning.

"Many people took up the subject (of heart irregularities) so far as the use of mechanical devices was concerned. Various instruments of

a more and more complicated kind were devised. Finally, the introduction of the electrocardiograph in great measure supplanted the method of pulse-record taking. This has been most unfortunate . . . for the simplicity of the latter method (pulse-tracing taking) allows it to be used under all conditions, whereas the more elaborate methods are suitable only in laboratories where the doctor is apt to be removed from contact with the patient. The sensitive index finger of the experienced doctor can give far more valuable information than all the instrumental methods in the world. . . . *When I see the modern cardiologist getting his assistant to take an X-ray photograph of the heart and an electrocardiogram, and even a blood-pressure reading, and then behold him sitting down to study these reports, I am truly amazed. I never could have realized that the practice of medicine could have become so futile and ineffective.*"

Many years, however, were to pass before this "futile and ineffective" spectacle, so familiar nowadays, was to be displayed before Mackenzie's contemptuous eyes. In the meanwhile, the great problems which he had set out to solve remained as inscrutable as ever. He had made some discoveries, but he had not found how to foretell danger, in a case of pregnancy, from symptoms shown by the heart. Nor had he found what influence the pains of labour exerted on the activity of that organ. Even the method of "wait and see" was yielding but scanty result.

The intensely practical character of Mackenzie's mind left him in no doubt about his real position. Progress, where he was concerned, meant progress

in the actual practice of medicine, that is to say, increased power of foreseeing and preventing danger, and increased capacity to treat the sick. The acquisition of knowledge was only a step towards this object. The knowledge must be applied as soon as it was won.

He tried to apply his information about the different chambers of the heart, and found that it was nearly useless. True, quite a number of patients who had very marked beating of the blood-vessels of the neck, were suffering from great exhaustion of the heart. But, on the other hand, the same excessive beating could often be seen in the necks of healthy folk. In other words, his new knowledge of the "Jugular Pulse," as he called the pulse in the neck, was of no avail as a means of enabling him to foresee and prevent danger. It was a sign merely; but a sign without significance.

And yet, queerly enough, many people, to this day, regard that discovery as Mackenzie's greatest contribution to medicine. Not so long ago, I heard a well-known and brilliant research worker speaking to this effect. He did not know, apparently, that the beatings and throbbings of the neck veins had been studied—before Mackenzie studied them, and unknown to Mackenzie—by Potain in France, and by Riegel in Germany, and that Mackenzie himself had acknowledged in one of his books that the interpretation of the waves given by these workers "was in the main similar to mine, though there were a few points in which we differed." He had

certainly not read the sentence in that book which followed:

"They viewed the matter purely from an academic standpoint, and did not attempt to apply it in practice—or, if they did, no success attended their efforts. I attempted to apply this new knowledge in practice in various ways."

As I have said, he found it useless. But his mind, which pursued ideas as a hound follows a scent, was moving swiftly nevertheless to a new revelation.

CHAPTER XIII

EXIT THE DUNCE

He was now enormously busy, a surgeon, as well as a physician, and an obstetrician. The practice at Bank Parade had grown, and was steadily becoming the best in East Lancashire. It consisted of county families, middle-class folk, and artisans, representing, thus, a "cross section" of the entire community. The demands made on the time and attention of the partners were endless, and the fact that old Dr. Briggs was beginning to fail in health and strength necessarily increased them, so far as Drs. Brown and Mackenzie were concerned.

Very soon after his marriage, Mackenzie found that he could think or write most easily in the early morning. He had a cup of tea in bed shortly before 7 a.m., and then rose and worked till 8. At that hour, he ate a frugal breakfast. By 8.45 he was in his "surgery," discussing with his partner the day's work, and making up his own list of visits. Nine o'clock saw him on the road, and it was not often that he returned before 1 o'clock. Midday dinner followed, and then, on three days a week, consultations in the surgery until tea-time. From tea-time till 7 o'clock,

when there was a second " surgery-hour," he was free. He employed this free time either at the Chess Club, or in listening to his wife playing the piano, which playing helped him to think. Supper followed at 6.30. On the days when he did not take the surgery hours, he usually played golf in the afternoons, and on most evenings he pursued his studies of French and German, both of which languages he quickly mastered to a sufficient extent to enable him to read medical papers and books written in them, or to carry on conversations with doctors. In addition, he devoted long hours to his beloved tracings, and to the copious notes which he kept of all the symptoms relating to heart trouble and to pain which he encountered.

Yet it is recorded of him that he never seemed to be in a hurry, or to be short of time. The methodical manner in which he planned his life, and which dated from the chemist's shop at Perth, secured him against that bugbear of most thinking folk. Impulsive as he was, he could control his thoughts, and move them easily and quickly from one subject to another. Thus, he took a great interest in local affairs at Burnley, and attended literary and other societies during the time when he was in the throes of some of his most important studies. The majority of men so situated would have been working behind closed doors, in a hush of self-importance. Mackenzie, on the contrary, could put his tracings aside, and join in the human pleasures of his family, or stroll round to the chess club " for a game." He could dispute with local worthies about the writers

they admired, what time problems of almost incredible perplexity were hammering at the doors of his mind.

In this respect he was a very sociable being. But where his scientific work was concerned, he was rather lonely.

That fact did not daunt him. His powerful, method-loving mind was content, even glad, to move alone along the way which it had chosen. Not for an instant had it relinquished its quest—to discover symptoms and signs of heart weakness which might enable him to foresee danger, and so to prevent it, more especially in the case of pregnant women. Indeed, I am inclined to think that while he played his games of chess or billiards, even perhaps while he went round the golf courses of the neighbourhood, his subconsciousness was actively at work on his great enterprise.

He had discovered, as we have seen, a method of finding out how two of the four chambers of the heart were behaving at any given moment. He had also, at an earlier period, made the discovery that pregnant women tend to show irregularities of the pulse. Suddenly, in a flash of inspiration, the idea occurred to him to find out, by the use of his new method, what the different chambers of the heart were doing when that organ was beating irregularly.

"When I look back upon the time when I conceived this idea," he wrote, long afterwards, "I realize that I had no notion of the great field that it opened up."

The year 1890 had just begun. Very soon a

patient presented himself with a marked irregularity of the heart—what he himself described as "missed beats." Mackenzie felt his pulse, and detected with his finger the gaps in the normal rhythm which were occurring—gaps obviously due to pauses in the beating of the left ventricle. He tied his little machine to the patient's wrist, slipped a piece of smoked paper into it, and then adjusted the pill-box-shaped tambour to the throbbing vessels of the neck. He set the paper running, and saw the "pens" write their swift record. He took another tracing, and then another. The patient left him. He sat down, without waiting to varnish his treasure, and glanced at it. The colour mounted to his cheeks, and his eyes began to glow! . . .

He could see that, at the moment when the beat was supposed to be missed, the left ventricle of the heart had contracted or given a beat out of its proper time (too soon), whereas the auricle had maintained its normal rhythm. In other words, the ventricle or lower chamber, had contracted before the auricle, or upper chamber; whereas, in the normal course of events, the auricle always beats before the ventricle.

This was a discovery indeed! *For the first time, the truth had been disclosed: that the chambers of the heart might fail to keep step with one another; that they might beat out of their correct and proper order.*

"I can remember," wrote Mackenzie, thirty years later, "the excitement which filled me when

I fully appreciated this discovery. To-day, of course, the idea of getting excited about the discovery of an Extra-systole (the name given by Mackenzie to this form of irregularity of the heart) will seem absurd; but it must be borne in mind that, at that time, no one had the remotest idea of how this commonplace form of irregularity was produced. To the investigator, no delight is equal to that which comes when Nature's curtain is drawn aside for a moment, however brief that moment may be."

He added, as though with a sigh:

"When, however, I announced my discovery, no one believed it, and no one accepted it, even although I sent my papers describing this and other observations to the leading physiologists of the day. It was practically not until Cushny (Professor Cushny, the distinguished pharmacologist) demonstrated the occurrence of the extra-systole in the mammalian heart by experiment that people would believe that what Marey had recognized in the frog's heart long before, was true also of the human heart.

"*Notwithstanding the complete indifference with which my work was viewed, I knew that I was getting at the truth.*"

At last, that is to say, the man who had always supposed himself to be a dunce, came to a realization of his real capacity and mental stature. From that hour, he deferred no longer to the "giants" who had so long dominated his intellectual horizon.

CHAPTER XIV

A SOLDIER OF TRUTH

I CONFESS that few episodes in Mackenzie's life afford me a deeper satisfaction than this belated recognition by him of his own genius. With his two hands, with his brain, he had gathered together such proof of his powers that even his stubborn self-depreciation was put to rout. He could not help knowing that he was "getting at the truth." And to know that was to know himself a pioneer, an architect of the future.

But it was to know much more than this. It was to realize suddenly dreams, the memories of which came hauntingly from childhood days; dreams of service, of chivalry. It was to take off the dunce in a spiritual as well as in an intellectual sense, and to put on instead the whole armour of knighthood. From this hour, till his life's end, Mackenzie was a soldier of that truth which he knew and loved. And the truth made him whole. It gave him a new confidence in his own powers, and a new determination to exert them to the uttermost. It inspired him with fresh resolution, so that the diffident student was changed, miraculously, to a leader and a master of his

craft. Mackenzie had, by the sheer force of his will, conquered himself, his impulsiveness, his shyness, his excessive humility; but now something more than mere self-conquest was afforded him. In that hour when first he "knew that he was getting at the truth," he reached, perhaps, the supreme moment of his life.

I journeyed to Burnley, a short time ago, to see for myself the town where he began and continued his labours. I came to the place towards evening on one of those smoky summer days when the valleys are full of light mists, and only the summits are clearly defined. The setting sun kindled the mists and the smoke, till they glowed as with inward fire. Great whorls of black smoke, newly belched from high chimneys, floated above this roseate, diaphanous stuff. The effect was strange and moving, for my journey had brought me from Manchester through miles and miles of dreary streets. It seemed that Burnley was a place other than the places I had left behind, girdled, even in its workaday aspect, with mystery and wonder.

In that mood, I came down through the bare streets, full of the sound, like castanets, of the wooden clogs, to Bank Parade. Burnley, I do not doubt, can be drab and dreary enough—for the "wheels of iron" always, sooner or later, quell the laughter of men and women. But I think that Mackenzie must have seen and known it—and perhaps loved it—often, with the red fire and the black, curling smoke about its roofs, and I like to picture his young face, tense with new

zeal, aglow with his pursuit of truth, against that background. Beheld so, it is the face of Chivalry herself, of knighthood, which is the symbol of a man's striving for his brethren against the elemental darkness.

BOOK II

"THE KNIGHT"

And what he greatly thought, he nobly dared.

CHAPTER XV

THE SERVICE OF THE SICK

MACKENZIE was pursuing his investigations along two definite and distinct lines. He was trying, on the one hand, to find out how symptoms of ill-health were produced—that is to say, which organs of the body were concerned in giving rise to them—and, on the other hand, he was waiting to see what would happen to men and women and children who showed these symptoms. The two lines converged at last, as he had hoped from the beginning that they would converge, on his great discovery of the secret of irregular heart action.

I have already described the first moment of triumph which attended that work—the moment when the young doctor found that the four chambers of the heart do not always keep step with one another. Thanks to his study of the throbbing blood-vessels of the neck, he was able to say, and to show, that in some cases of irregular action, the ventricle—that is, the lower chamber—"went off at half-cock," beating before its correct time, but that the auricle—the upper chamber—maintained its normal rate and rhythm (and so, actually, beat after the ventricle). Thanks to the fact that he had long ago made careful notes and

tracings of all his patients who were troubled with this form of irregularity, he was able to say—at the moment when he discovered the secret of the irregularity—that it was not, probably, a serious symptom. The method of "wait and see" was beginning, after six years, to bear the expected fruit.

In other words, the patients whose pulses Mackenzie had found to be irregular when he began to keep his notes of symptoms, and to take his tracings with the Dudgeon's Sphygmograph, and whose form of irregularity he could now identify as due to an "extra-systole" or extra-beat of the ventricle, were all alive and well, and in active work, six years later. Many of them, during the intervening period, had led strenuous lives, and performed heavy manual labour. A number of the women had passed safely through the ordeal of childbed. It could therefore be said with confidence that this form of heart irregularity appeared to exert no evil influence over a comparatively prolonged period of time.

Mackenzie devoted himself with all the eagerness of a detective, who feels that his methods have led him to a correct solution, to the disentanglement of the various pulse irregularities. He had, as I have indicated, kept all his carefully varnished tracings and was thus possessed of accurate records going back for at least six years. He had, in addition, his notes of symptoms. Thus, as he identified each type of irregularity he was able, by inquiring what had happened to the patients showing it, to form an estimate of its

importance as a sign of impending trouble. When, later, new patients with that irregularity came to him, he could warn them of danger, and tell them how to avoid it, or, if the sign was not a serious one, he could set their minds at rest with great confidence. He was, at that time, the only man in the whole world who was possessed of this particular knowledge.

When, however, he tried to share his knowledge with others, he soon found that they were by no means so eager to accept it as he had expected. On one occasion, in London, he addressed a very distinguished gathering of heart specialists, and told them that a certain form of irregularity of the pulse—the extra-systole—was of no serious consequence to the patient.

"I have never," he declared, "known any harm to befall any one in whom this irregularity was the only sign of departure from the normal."

He sat down. One of the leaders of the profession rose, and in round and emphatic tones announced:

"I had four patients whose pulses were irregular in the way described by Dr. Mackenzie. *They all died.*"

Quick as a flash came Mackenzie's retort.

"I had 400 patients with bald heads. They all died. *But it wasn't the baldness of their heads that killed them!*"

Mackenzie could afford to use language of that sort simply because his method of Wait and See had supplied him with a test of, and a check on, his actual research work. Not only was he

enabled to say, "This irregularity of the pulse is due to premature beating of one of the chambers of the heart," but also, "All those patients who showed it six years ago are still in good health and activity." And he was entitled to add, "Therefore such premature beating is not a serious matter, and should not alarm the doctor who detects it."

The power to make positive statements of this kind may not, at a first glance, seem to be so very important. But let the reader employ his imagination, and picture to himself his own feelings, were he to detect "a missed beat" of his pulse. He would, naturally, be filled with anxiety; that deep and increasing fear of the unknown. He would lose no time in going to his doctor, and he would have in mind, as the object of this visit, a perfectly clear idea—to find out whether or not his "missed beat" was "serious."

Let us suppose that his doctor did not really know if it was serious. In that event, the doctor would be almost certain to adopt a "careful" attitude. He would advise rest, and would warn his patient against such sudden strains as "running for a 'bus." He might forbid smoking. He might order a short period in bed. These precautions would not in the least affect the "missed beat," which cannot be removed in that way, but they would greatly affect the patient. They would frighten him. They would convince him that his heart was either strained or diseased. He would, almost certainly, betake himself to a "heart specialist" of repute.

Let us further suppose that this ornament of his profession entertained the views about "missed beats" which called forth Mackenzie's retort respecting bald heads. He also would adopt a cautious attitude. He would repeat the advice about avoiding sudden strains, and would thus confirm the patient in all his fears. The wretched man would stagger out of his consulting room into the street with the figure of Death before his eyes!

Mackenzie had a decisive way with such patients. He told them simply that there was nothing wrong with them; and he spoke always with the conviction of a man who knew that he was speaking the truth. Thus he rescued hundreds of men and women from despair, and restored them to their daily work.

Nor was this great service confined to men and women. Children, too, shared its benefits. There is a form of irregularity of the pulse in which the rate changes with changes in the breathing. If, for example, a breath is drawn into the lungs, the pulse beats more rapidly; when, on the contrary, the breath is expelled from the lungs, the pulse becomes slow. This type of irregularity engaged Mackenzie's attention as soon as he had discovered the secret of the extra-systole. He quickly found that it differed entirely in its mechanism from the latter condition. In the extra-systole, which Mackenzie first elucidated, the ventricle beat "out of step," whereas the auricle maintained its normal rhythm. In the irregularity connected with the breathing, on the other hand, both auricle

and ventricle "kept step" with one another. The irregularity was caused not by premature beating of one or other or both of the chambers of the heart, but by changes in the rate of beating of the heart as a whole. As such changes were brought about by the breathing, it seemed evident that they must be effected through the nerves connecting the heart with the lungs. In other words, the cause of this type of irregularity lay outside of the heart altogether, in the nervous system. Reference was now made to the records of the irregularity taken five or six years earlier, and it was found that those patients who showed it had, without exception, remained fit and well.

The majority of them were young folk, whereas the majority of those who showed extra-systoles were persons in middle or old age. Consequently, Mackenzie called the irregularity associated with the breathing "The Youthful Type of Irregularity," and the various forms of extra-systoles, "The Adult Type of Irregularity."

"I found," he wrote, "the 'Youthful Type' most distinct in perfectly healthy children and youths. When the heart slowed down after a febrile attack, such as measles, it was very often distinct, but even in healthy youths accustomed to playing strenuous games, it was often very marked. I watched those who showed this irregularity grow into manhood and womanhood, and observed many of them during temporary illness and during periods of severe bodily effort. They never showed any signs of cardiac weakness, even when they were engaged in hard manual

labour. I therefore concluded that this condition was a physiological one.

"The extra-systole gave me a great amount of labour to find out whether it was a sign of any serious moment. As I found it in apparently healthy people engaged in work that entailed severe bodily labour, its cause did not seem to impair the heart's strength. I found it disappeared when the heart's rate increased during a febrile illness, and that it sometimes appeared during a febrile attack. While thus engaged, I met with several patients, mostly elderly, who developed this form of irregularity during acute febrile illnesses, such as bronchitis and pneumonia, and who died. I then considered that its occurrence with febrile conditions was of serious significance, and this view held good for about three years, after which I began to meet with cases that recovered, and so found the sign of little help. After watching large numbers of people for many years, I came to the conclusion that this irregularity was, as a rule, but one of the changes that accompany advancing years, of little importance in otherwise healthy people."

It will be apparent that the method of waiting and seeing was no mere passive procedure. The findings of one year had to be corrected in the light of the findings of the next until, as the years passed, final conclusions could be reached. In other words, Mackenzie's opinions—even the most apparently trivial of them—represented vast and intricate labours, and were based on experiences which included the continuous observation of hundreds of patients. Those who, in after years, attempted, lightly, to controvert him, as a rule

overlooked this fact. Not having themselves employed the method of Wait and See, they had no idea how enlightening that method is, nor how completely it arms its practitioner against the facile guesses of any opponent, no matter how nimble-witted.

Mackenzie's work on these two forms of irregularity—the youthful and adult types—is now accepted the world over; it has become a part of the knowledge of the medical profession; it is employed every day of the year. That is to say, thousands—nay, hundreds of thousands—of men and women and children who, had the Burnley practitioner not lived and laboured, would, in all probability, have been treated as heart-cripples, have been and are being reassured as to their condition, and so enabled to fulfil their destinies.

Is not this a real and solid service to humanity? Does not it deserve to be placed side by side with such achievements as vaccination and the operation for appendicitis? There can be but one answer from thinking people. Yet to-day, unhappily, this so-called "negative" aspect of Mackenzie's work is apt to be discounted or forgotten. He refers to this fact himself in the last edition of his great text-book on the *Diseases of the Heart*, remarking that to-day the "Youthful Type" of irregularity is described in many books as having no evil significance. He adds, with fine irony:

"It does not seem to occur to any author" (making this statement) "to inquire how he has

obtained this knowledge. I do not doubt he would say it was learned from his own experience, and would not admit that he had borrowed it from me, or recognize at what expense of time and trouble it had been acquired.

"It took me fifteen to twenty years of patient observation, as it required the collection of an enormous number of records before I felt confident in the soundness of this prognosis" (that the youthful type of irregularity is not to be regarded as a sign of disease). "I had had the opportunity of seeing people in childhood, and observed their hearts during various illnesses. I watched children grow up and pass into manhood and womanhood, and observed how they bore themselves during periods of stress in playing games and undertaking hard work. The symptoms observed had to be compared with those in people with failing hearts, and after many years' patient labour, this prognosis was established."

As it happened, the very first patient Mackenzie saw when he began his great adventure in London, was a girl with the Youthful Type of irregularity of the pulse. *She had already spent three months in bed, and had been undergoing the Nauheim treatment.* He told her to get up and go on with her life, and this she did. Very shortly afterwards a boy was brought to see him with the same harmless form of irregularity. This lad had been forbidden to play games. He had spent three months in bed in England. Then his sorrowing and anxious parents had taken him abroad to a great Continental clinic, where he had been treated for months. As no improvement followed—as, that

is to say, the harmless irregularity of the pulse continued—the lad was next taken to another Continental specialist, from whom he received treatment with various hypodermic injections of drugs. These did not remove his supposed affliction, and so, finally, his father and mother were told that he had "an incurable disease," and that he would never be able to play games, or undertake any strenuous physical work. Mackenzie comments laconically:

"I found the irregularity to be that of the Youthful Type, and recommended that the boy should at once begin to play games and lead the life of a healthy youth. This he did, and after his schooling was over, he entered the army, and went through the War with no trouble from his heart."

Small wonder that the consulting-room of a man able to speak with such authority was crowded from morning till night. What his professional brethren were very slow indeed to perceive, the public, with its quicker intuitions and greater necessity, apprehended in an instant. To the bulk of the profession, the knowledge which Mackenzie acquired by "waiting and seeing" has always appeared to be less valuable than the knowledge he acquired by his tracing-machines. As he commented bitterly on one occasion, in reference to this same Youthful Type of Irregularity:

"If some remedy had been discovered which would have 'cured' this condition, the whole medical world would have resounded with its

praise; but because a far more important discovery was made" (namely, that the irregularity was not of any account) "by the employment of methods which belong to the higher sphere of medicine, the value of the discovery is unappreciated."

Mackenzie, on the last occasion on which I saw him, assured me that he had failed utterly to get the majority of the members of his profession to realize even the need for obtaining the kind of knowledge which his method of Wait and See affords. He believed that what he had been able to accomplish in the case of heart troubles, required to be achieved also in every other department of medicine—in connection with troubles of the stomach, of the bowels, of the kidneys, of the brain, and so forth. If only the doctor would understand that he must be able *to foresee danger*, and that, in order to do this, it is necessary to know which symptoms are innocent, and which are true warnings of impending disaster—to know, that is to say, what happens to those showing a particular symptom, and also in what manner every symptom is produced!

Let it not be thought for a moment, however, that in pursuing his own special methods of work, Mackenzie neglected any of the methods in general use by his fellows. His opponents often fell into this very mistake about him—with, as a rule, disastrous consequences for themselves. No man ever used a stethoscope with a higher degree of expertness than this man who declared that the stethoscope had "not only for one hundred years hampered the progress of knowledge of

heart affections, but had done more harm than good, in that many people had had the tenor of their lives altered, had been forbidden to undertake duties for which they were perfectly competent, and had been subjected to unnecessary treatment because of its 'findings.'" No man again ever performed, single-handed, more *post-mortem* examinations than this man, who besought his professional brethren, with all the earnestness at his command, to forsake the study of death for that of life.

Mackenzie was a terrific worker, a worker who spared no effort of any sort to discover the truth, or to use it for the benefit of his patients. But the benefit of his patients was always his first consideration, and methods which seemed to him lacking in the power to contribute to this benefit were quickly "scrapped," no matter how impressive they might appear, or how strongly entrenched they might have become in the affections of his profession.

The young knight, indeed, was aflame with the desire to serve the weak and the sick, and he was ready, as every young knight should be, to attack any interest or any ignorance, no matter how powerful, in this great and holy cause.

A physician who knew him well has left the following account of him during this great period of his life :—

"It was my good fortune to visit Mackenzie at Burnley, and to see him at work in his daily round of visits. Every one must have been struck, as I was, by his extraordinary geniality and charm

of manner. I think he was a born optimist, and this quality alone, combined as it was with a bright and overflowing humour, certainly helps to explain the amazing power and influence he exerted over his patients in the way of helping them towards recovery. His humour never hurt, even when it took the form of 'chaff,' as happened often enough with his intimate friends; his very laughter was infectious.

"In the days when I stayed with Mackenzie in Burnley, he was specially interested in the changes in the maternal circulation in pregnancy. In these days, he personally attended all cases of labour complicated by heart-disease, and he devoted an immense amount of time and trouble to the suffering mothers. It was lovely to see their absolute confidence in him, and the affection in which he was held.

"Perhaps I may be allowed to mention one special instance which, as a young general practitioner of ten years' standing, impressed me tremendously. Mackenzie did a large consulting practice, even in these days, and he was called to a neighbouring town to see a little girl who had been very seriously ill for about a week. The country doctor was very anxious, and the parents were in a state of the utmost depression. Very well do I remember how Mackenzie's grave, serious face lit up into a happy smile as he listened to the little child's back. He was quite excited as he turned to me and said, 'Nicholson, listen to this; it's a resolving pneumonia.' As he spoke to the mother and patted her on the shoulder, his pleasure was as great as hers. 'Your little girl has been very ill,' he said, 'but she is going to get quite well.' Never have I seen an atmosphere of such intense gloom changed in a moment to one of perfect

sunshine: I realized, for the first time, the full meaning of the words, 'beloved physician.'

"Can we be surprised, then, that, as Mackenzie went from house to house, his steps and his voice were loved and welcomed in each? He brought air and cheer into the sick-room, and always, when possible, healing. Some of the specialists, among whom he ultimately became the greatest of all, may wonder why this remarkable man has constantly praised the general practitioner, and regarded his work so highly. I think I, for one, know; and I feel that most of his friends also understand."

But there was nothing soft or sentimental about Mackenzie. It was his practice, at Burnley, to take a short sleep after luncheon. One day, while he was taking the rest, two men began to fight in the street outside his house, making a great din. They awakened him. He looked out of the window, saw the fight, and went out and thrashed both men so severely that they ran away. He then returned to the house, and resumed his sleep as if nothing had happened.

On another occasion, during a labour quarrel at Burnley, some of the wilder men, not themselves parties to the dispute, took to obstructing the streets of the town. The hands of the police were full elsewhere. Mackenzie, hurrying to see a patient, was held up. He instantly sprang forward ahead of the crowd, seized two of the ringleaders, and banged their heads together as if they were schoolboys; upon which their comrades fled, leaving the street open.

CHAPTER XVI

DANGER

MACKENZIE'S visits to his patients sometimes lasted three hours; sometimes they lasted three minutes. But, in any case, no time was wasted. When he came to the door of a house, he knocked once and then entered without further ceremony, and betook himself immediately to the sick-room, greeting the patient as a rule with the words:

"Well, and how are you to-day?"

It was not merely a conventional salutation. It was a question; and the reply he got to it always received attention. He had the deepest possible faith in the value of subjective evidence, that is to say, of the sick person's own knowledge of himself and feelings about himself. The earliest signs of disease, he knew, are to be found in the patient's sensations.

But he saw to it, nevertheless, that garrulous folk did not waste his time, nor selfish folk squander it with long, meaningless harangues about their feelings. On one occasion, at the very height of his London career, he was called to see a great leader of the social world, a woman famous for her powers of speech. The doctor who called him in had heard of Mackenzie's objection to mere talkativeness, and awaited the encounter with,

some interest and amusement. It lasted precisely four minutes, during which period the physician's increasing annoyance could be seen in his heightening colour and flashing eyes. When he could endure the ordeal no longer, he declared in those tones which none cared to disobey :

" My good woman, would you kindly hold your tongue ! "

She remained his staunch friend to the end of her life, boasting that he was the only man who had ever effectively silenced her, and adding, with great insight, that his stern manner had pulled her together and done her a great deal of good. As I have stated, Mackenzie wasted neither time nor words. Almost everything he said was said with a purpose.

In this respect he resembled, in many ways, a great detective. His most apparently casual questions and even glances were often, really, tests designed to catch disease, so to speak, unawares, and so to convict it. He was always, too, on the watch for the next possible or probable move of the enemy, even in those cases in which his knowledge was too slight to allow him to indulge in any definite anticipations. This feature of the method of " wait and see " should be clearly realized. Mackenzie's waiting often resembled that of the sportsman in his shelter among the trees, waiting for the stealthy coming of his quarry. What he ultimately saw was, very often, exactly what he had expected to see ; that is to say, what his labours in other directions had already led him to suppose was likely to happen.

One day, for example, he entered a house in Burnley, and was told that his patient, a woman, had become desperately ill since his last visit. His face betrayed nothing of the distress which this news occasioned him; yet the truth was that he had been fearing the onset of exactly such an attack for eighteen years. During the whole of that long period, he had watched this woman closely and continuously, and for many years he had tried, by various means, to ward off from her the heart failure which he saw approaching.

That, in itself, would not be a course of action calling for special notice. Every doctor fears the onset of heart failure in certain of his cases, and does what he can to ward it off. In this case, however, Mackenzie's fears were of a precise and exact nature. He feared something that no other living man could possibly have feared at that time, which something must, he thought, lead to failure of the heart.

What was this special dread, this move of the enemy, that Mackenzie had divined without being able to prevent? His reading of the riddle of the waves, as we have seen, had disclosed to him two types of irregularity of the pulse—a youthful type and an adult type. A third type, however, remained, in which the pulse was so enormously irregular, that no two beats seemed to be of the same length, or even of the same size.

He possessed a good number of tracings of this irregularity, and also a good number of records of the symptoms shown by the patients

suffering from it. After six years, a number of these patients were dead. Others were obviously very unwell, and suffering from various degrees of heart failure. A few remained comparatively fit. This was an entirely different state of affairs from that met with in the case of the Extra-systole or of the Youthful Type of Irregularity. In these cases, all the patients had been well and active after six years. . . . There could be small doubt that the Third Type of Irregularity was a Danger Type.

Mackenzie applied his new method of pulse-reading to the first case of this Danger Type which he encountered. To his surprise, he found that the throbbings of the blood-vessels in the neck were different here from those met with in other cases. For one thing, the first of the three waves usually seen in tracings of the neck-throbbings was absent; for another, the jugular vein bulged out during the beat of the Ventricles instead of collapsing, as occurred in the majority of men and women.

He studied this bulging of the vein very closely. It was exceedingly puzzling, because the veins lead into the Auricles of the heart, and, when the Ventricles beat, the Auricles have become flaccid again. How could a flaccid auricle send a wave flowing up the jugular vein?

In other words, how could the *opening* of a sluice gate cause the damming-up of the stream above it? In all the other tracings of the neck-throbbings, that is to say, all the tracings which were not of this Danger Type, the jugular vein

in the neck became empty, and ceased to throb at the moment when the Ventricles of the heart beat. This was, of course, entirely comprehensible, because, as has been said, when the Ventricles beat, the Auricles become flaccid. Naturally, the re-opening of these chambers must allow blood to flow into them from the veins, and so must tend to empty the veins.

There could, however, be no escape from the fact that, in the Danger Type of Irregularity, the beating of the Ventricles coincided with a bulging instead of with the usual emptying of the neck veins. Nor could the fact that, in this type, the first of the three waves, the auricular wave, was absent from the tracings of the neck-throbbings be disputed. Mackenzie could not explain what he saw, but he could make a record of it. He did so, calling the type of neck-tracing in which the jugular veins bulged during the beat of the ventricles (the Danger Type), "The Ventricular Form of the Jugular Pulse," to distinguish it from the normal, or "Auricular Form of the Jugular Pulse" in which the wave made by the auricle can be seen.

Naturally, the mystery of the Danger Type of Irregularity interested the young doctor profoundly. Having failed to solve it, as he had solved the mysteries of the extra-systole and the Youthful Type of irregularity, he fell back for enlightenment on his method of "wait and see." He gathered together all the tracings and all the notes which he had made, seven or eight years before, of patients showing the Danger Type,

and began a most searching scrutiny of them. He also renewed and redoubled his pains to find out exactly how each of them had fared in the intervening years, and how each of them was at that present moment.

This investigation showed that the Danger Type of Irregularity occurred mostly among elderly people who had suffered at one time or another in their lives from attacks of rheumatic fever, and that it was present in at least eighty per cent. of all cases in which signs of heart failure, and also dropsy and enlargement of the liver, were manifest.

This was important information; a clue as enlightening as it was unexpected. Once again the method of "wait and see" had more than justified the confidence originally reposed in it. Mackenzie at once asked himself, "What is the connection between the dropsy, the enlargement of the liver, the heart failure, and the Danger Type of Irregularity?"

He could not answer this question. So, once again, he sought from others the information which he lacked himself.

CHAPTER XVII

"THE GIANTS"

It was the teaching at this time that dropsy and enlargement of the liver, which occur in cases of heart disease, are due to "Back-pressure."

This teaching had a respectable history, and was founded on what seemed to be a very solid foundation. It owed something to the great Harvey, the discoverer of the circulation of the blood; it owed still more to the discoverer of the stethoscope; finally, its debt to the *post-mortem* room, the "dead house," was very great indeed.

The heart, as is well known, possesses a number of valves or trap-doors, the object of which is, evidently, to allow the blood to flow in one direction, but to prevent it from flowing back in the opposite direction. So long as these valves are in good working order, every beat of every chamber of the heart must therefore move the stream of blood onwards—so much for the debt to Harvey.

Each time the heart beats it gives forth two sounds, usually represented as "Lubb-dup," which can be heard with the stethoscope. These sounds are made, in part at any rate, by the closing of valves. "*Lubb*" is the sound of the closing of the valve between the left auricle and

the left ventricle; "*dup*" is the sound of the closing of the valve that shuts off that greatest of all blood-vessels, the aorta, by which the whole body is supplied with fresh, arterial blood, from the heart. Early listeners with the stethoscope noticed that sometimes the sounds of the heart were altered. Instead of the usual "*Lubb-dup*," there might be heard "*pff-dup*," or again "*Lubb-pff*," or "*pff-pff*." In other words, each or both of the heart sounds might be replaced by a "murmur." It was observed that a good many people who had "murmurs" in their hearts were weak, and showed signs of heart-failure. A number of these died. On examining their bodies after death, the physicians found that, very frequently, the heart valve of which the sound had been replaced by a murmur, was obviously damaged. If, for example, the sounds "*pff-dup*" had been heard during life, instead of the normal "*lubb-dup*," then, after death, it would often be discovered that the valve situated between the left auricle and the left ventricle was so far damaged as to be incompetent to prevent the back-flow of blood. This valve possesses two flaps, or cusps, and, when open, resembles a bishop's mitre. For that reason, it is known as the "mitral valve." When it fails to close completely—and so allows the blood to flow backwards into the auricle during the beat of the ventricle—the patient is said to suffer from mitral regurgitation. When, on the other hand, the opening which it is designed to close becomes narrowed as a result of shrinkage round the valve

base, the patient is said to suffer from mitral stenosis or mitral narrowing. Troubles associated with the valve, the closing of which produces the sound "*dup*," are called, as the case may be, aortic regurgitation or aortic stenosis, or, simply, aortic disease.

Here, then, was a chain of reasoning built up by successive generations of physicians, and regarded by all as a shining example of the progress made in the knowledge of heart disease. Any doctor aware of the manner of the circulation of the blood, could see that if, say, the mitral valve had broken down, blood would be "regurgitated" or driven back from the ventricle into the auricle during each ventricular beat. This must, without doubt, weaken the circulation by impeding its flow, and also by reducing the amount of blood "sent forward" at each beat. Moreover, it must—or so the argument ran—cause a "back pressure" to be exerted on the lungs, from which the blood flows into the left auricle, on the right side of the heart from which the blood flows to the lungs, on the veins from which the blood flows to the right side of the heart, and finally on such organs as the liver, from which the blood flows to the veins. "Back pressure," in short, caused a damming up of blood in the veins, and so a leakage of fluid out of the veins into the flesh (dropsy), and a swelling of various organs (enlargement of the liver, and so forth).

It cannot be denied that this explanation was attractive in many ways. It was a "theory of the crime" into which most of the known facts could

be fitted. Each clue was, so to speak, represented. It was therefore taught with the utmost conviction to all medical students, and it was held as an article of faith by all doctors. As soon as a doctor heard a mitral regurgitant murmur, i.e. "*pff-dup*," the danger of "back-pressure" rose in his mind, and he made haste to warn his patient to lead a quiet, easy life, and to avoid stress or excitement, lest the "hole in the valve" might be made larger.

This advice is still given, in similar circumstances, by many doctors, for the fear of back-pressure haunts the minds of the medical profession of to-day almost as continuously as did the fear of the night air haunt the minds of their grandfathers. Not very long ago I heard a distinguished practitioner assert:

"I learned the doctrine of back-pressure from the lips of the giants of my profession."

It was quite evident that he regarded this fact as reason for adhering to it "in spite of Mackenzie."

Mackenzie soon found, when he tried to obtain light on his Dangerous Type of Irregularity, that the "giants" were very far from sharing his excitement and anxiety about the interpretation of his tracings. They did not know what he was bothering about, and they certainly did not desire that he should bother them.

I have, in the pages which follow, made some use of, and play with, the word "giant," which came to me thus accidentally, because it seems to me to express, better than any other word of

which I can think, certain mental qualities belonging then, and belonging now, to some of the leaders of the medical profession both in Scotland and in England.

It is, for example, on record that while some giants were men of morose or even savage temper, the majority were good-humoured; and these last displayed, as a rule, a signal laziness both of body and mind. Thus the adage to "let sleeping dogs lie" must have applied with special force to sleeping giants.

The task of rousing giants, therefore, must have been a thankless one from the very beginning. Mackenzie soon found that it has remained thankless throughout the ages. His questions and his contendings were met, in the first instance, with the equivalent of loud and peaceful snores. Had not this troublesome fellow heard of the work on Back-pressure? The revelation, in short, was complete. The very idea of adding to it, or taking from it, was blasphemous. Nevertheless, the Man of Burnley would not be silenced.

How comes it about, he asked, that the signs and symptoms of what you call "Back-pressure" occur in patients the valves of whose hearts are absolutely intact and healthy? Again, how is it that some patients with broken-down valves do not show any signs of back-pressure at all? Surely, if back-pressure is the true explanation of the dropsy and the enlargement of the liver, these symptoms will only appear in cases in which a valve has broken down seriously, and will always appear when that catastrophe has taken place?

The snoring of the giants punctuated these eager queries. Its tranquil rhythm was not altered. Had not the fellow heard of Compensation?

Mackenzie had indeed heard of "Compensation," that mysterious power of increasing its bulk and energy which the heart was—and is still—supposed to possess, and was—and is still—believed to exercise when its valves have been damaged. He had devoted long hours to the contemplation of this cardiological miracle, whereby the evil influence of back-pressure was "compensated," or made of non-effect, by an increase of the very force reputed to be the cause of the evil. Here indeed was a modern instance of Beelzebub casting out devils! How could back-pressure be cured or relieved by more back-pressure?

As nobody seemed to be able to offer any answers to these questions, the young doctor was driven to try to solve them by his own methods. He had, as has been stated, discovered already, by reference to his notes, that he had found the Dangerous Type of Irregularity of the pulse present in at least eighty per cent. of his patients who suffered from heart failure, with symptoms of dropsy and enlarged liver. Further, he knew that this type of irregularity occurred oftenest in old people, and very frequently occurred in people who had suffered from rheumatic fever. He came to the conclusion that he could not hope to solve the riddle until he had seen the actual onset of the irregularity.

"I, therefore," he wrote, "set myself the task of watching people whom I had attended during attacks of rheumatic fever, and people getting on in years. I had to wait and watch several years before I obtained a satisfactory result, but when it came, there was revealed far more than I expected."

The spectacle of this stripling watching while the giants trumpeted would not lack its humour, did not one remember that Mackenzie was no mere research worker, interested only in cases and experiments. He was a doctor, interested in men and women. And so, while he watched for the onset of the Dangerous Type of Irregularity, as a man might await the spring of a tiger, his heart was heavy. He was awaiting an evil he had foreseen, but could not, so far as he knew, prevent.

CHAPTER XVIII

THE BLOW FALLS

THE expected blow fell, as I have mentioned above, on a woman patient whose heart trouble Mackenzie had been treating and observing for eighteen years.

He had seen this patient first in the year 1880, very shortly after he came to Burnley, and had then attended her in an attack of rheumatic fever. She was thirty-one years of age at that time.

This, however, was not her first attack of rheumatic fever. That, as he learned, had occurred nine years earlier, when the patient was twenty-two years old. He soon found that it had inflicted damage on the heart, for a sign known as a pre-systolic murmur could be heard in that organ.

I have stated that the normal heart sounds resemble the words "*lubb-dup*," and that the first sound, "*lubb*," is occasioned by the closing of the mitral valve, which valve lies between the left auricle and the left ventricle. "*Lubb*" therefore corresponds in time to the systole, or beat of the left ventricle. It is the systolic sound, and when it is replaced by a murmur, "*pff-dup*," that murmur is called "systolic."

It follows that a pre-systolic murmur must occur before the beat of the ventricle, that is to say, while the mitral valve is open. It cannot, therefore, be due to a back-flow of blood. It must, on the contrary, be connected with the normal activity of the auricle, which, as has been stated, beats before the ventricle, and, by its beat, fills up that chamber.

When Mackenzie listened to his patient's heart, he heard, just before the usual "*lubb-dup*," a rough sound like an oft-repeated letter R, thus: "*rrrlubb-dup*." He knew that sinister note, and he knew the cause of it. The opening between the auricle and ventricle must have been damaged during the first attack of rheumatic fever. Such damage takes the form of inflammation, and when this passes away, the inflamed place tends to shrink, just as a scar on the skin shrinks while it heals. Shrinkage matters nothing where, say, the back of the hand is concerned; but, as can readily be understood, it is a matter of life or death when it occurs in one of the passages of the heart. It amounts, in these situations, to a wall built right across the main stream of the circulation.

Everybody knows how the babbling of a brook changes to a rushing sound when it comes to a narrow place in its course, and how this rushing sound is greatly intensified if the narrow place happens to be steep. In exactly the same way, the stream of the blood makes a rushing sound as it is driven through a narrow place in the heart. A pre-systolic murmur is this rushing sound. It occurs—be it noted—only at the moment when the

auricle beats, because only at that moment, as a general rule, is the blood passing through the narrowed opening under sufficient pressure to make a sound.

Mackenzie knew, therefore, on his first visit to this patient, that she was suffering from one of the most dreaded of all forms of heart disease. He had heard his teachers at Edinburgh describe the usual course of this affliction . . . the steady increase of the shrinking process, until the opening between the auricle and ventricle should be well-nigh closed, until, that is to say, the circulation should be " stopped up " like an obstructed water-pipe. He warned the lady to take great care and to avoid all forms of exertion and exposure to cold, lest another attack of rheumatic fever should come to make matters worse for her.

In spite of these precautions, however, the patient got rheumatic fever again three years later, in 1883, and was no sooner recovered from this attack, than she fell into another, in 1884.

Her position was now very bad. She was thirty-five years of age, and she possessed a heart one of the main passages of which was shrunken with old scars and, at the same time, freshly injured by new inflammations. These new inflammations, as they subsided, would inevitably cause further shrinkage, and so close a little more completely the " door " between the two chambers, the left auricle and the left ventricle. The young doctor repeated his cautions, and made up his mind to keep his patient under close observation so that he might be ready, at all times, to

help her, and to hinder—if that should be possible —the march of her disease.

His care was by no means unnecessary. As the passage between the chambers of the heart grew narrower, various signs and symptoms made their appearance. The pre-systolic murmur became more definite and pronounced, as though the beating auricle was driving its stream of blood against an ever-increasing resistance. The poor woman suffered, too, from severe pain in the region of the heart, and from stomach trouble of such a nature as to suggest the presence of an ulcer of that organ. Mackenzie carefully treated all these complications while, at the same time, keeping close watch on the condition of the heart. When he made his discovery of the Dangerous Type of Irregularity of the pulse, and of its connection with rheumatic fever, he redoubled his watch. Here, surely, was exactly the type of person—the victim of four attacks of rheumatic fever—who stood in peril of the onset of this Dangerous Type of Irregularity.

He took many tracings of the pulse and of the throbbings in the blood-vessels of the neck of this patient. But these tracings were absolutely normal. The pulse was perfectly regular, and the three waves of the neck-tracing followed each other in precise rhythm, showing that the various chambers of the heart were keeping accurate step.

And so it continued until the year 1898, until, that is to say, the patient had reached her fiftieth year. Then, with dramatic and terrible suddenness, the change which Mackenzie had so long

feared took place. One day this victim of rheumatic fever and of its dire consequences, was seized, in a moment, with great breathlessness, and became desperately ill. In that moment, the Dangerous Type of Irregularity made its appearance.

Her condition was now completely altered. She was manifestly at death's door. She was dropsical, and the liver had enlarged. Her pulse was "flying," and had become grossly irregular, both in its rhythm and in the strength of the beats. But, most amazing thing of all, the pre-systolic murmur, which had persisted in this heart for eighteen years—and probably for much longer—had miraculously vanished.

Mackenzie listened again and again, in the utmost bewilderment. What had happened to the murmur? It was not possible—he knew that it was not possible—that the narrowed passage in the heart had suddenly been opened up again. Yet the sound made by the blood as the auricle forced it through this narrowed passage could be heard no longer.

He gave his patient such treatment as he could think of, and managed to cause the terribly rapid pulse to slow down somewhat. The poor woman became more comfortable. But the Dangerous Type of Irregularity remained, and the pre-systolic murmur did not return. The doctor set these two facts before him, and brooded on them. He repeated to himself again and again the observation that, *at the very moment when the Dangerous Type of Irregularity supervened, the*

pre-systolic murmur became muted. What connexion was there between these two events? He made daily tracings of the pulse and of the throbbings in the blood-vessels of the neck. The neck tracings, like all the neck tracings in cases of the Dangerous Type of Irregularity, were destitute of the first of the usual three waves. That is to say, they were destitute of the wave made by the beat of the auricles.

But it was the beat of the auricles, forcing the blood through the narrowed passage in the heart, which caused the pre-systolic murmur. . . .

In a flash of revelation, the truth was given to this devoted searcher after truth.

The auricles of the heart had ceased to beat.

A year later, the poor patient whom he had attended so long died. Mackenzie was permitted, in the interests of humanity, to make an examination of her heart. He found the auricles, the upper chambers of the heart, enormously distended and greatly weakened in appearance. He gave, then, to this Dangerous Type of Irregularity the provisional name of "Paralysis of the Auricle." It is now, thanks to further labours by later workers, and notably by Sir Thomas Lewis, known as "Auricular Fibrillation." In his last days, however, Mackenzie himself returned to the use of the word "paralysis," in preference to "fibrillation."

CHAPTER XIX

THE PARRYING OF THE BLOW

So the heart could go on working when its two upper chambers, the auricles, had ceased to beat! Mackenzie tasted again the "sweetest pleasure" which a man of science can experience. He gazed, alone, on wide new fields of knowledge which his faith and his courage had opened to his sight.

At this time he had scarcely begun to write; but he spent long hours in thinking, what time his wife played the piano to him. And he carried his thoughts with him to the pretty victoria in which he drove about his practice. He had other patients who were victims of the Dangerous Type of Irregularity, and he had other patients who had suffered from one or more attacks of rheumatic fever and who, therefore, might become its victims. What could he do to cure and to prevent this condition?

He resolved to make a new, intensive study of it, and spent hours observing the patients who showed it. In some cases whole nights were devoted to the work, the urgency of which weighed on his spirit.

"Gradually," he wrote, "I detected the condition in a considerable number of patients.

Many were in fair health till its onset, when they became breathless, and showed a variety of signs of heart failure. In a few, death speedily followed. Others remained for years in a crippled condition."

And many showed the exact "picture of disease" which at that moment was regarded universally as indicating "Back-pressure." Mackenzie experienced a thrill of wonder as he realized this fact. According to the theory of "Back-pressure," as has been indicated, a gradual breaking down of a valve allowed the blood to flow backwards, as well as forwards, at each beat of the heart, and thus gave rise to dropsy, blueness of the skin, breathlessness, and so forth. But here were all these signs and symptoms produced in a single hour, and without, in many cases, any broken-down valve. His earlier doubts about the truth of the Back-pressure doctrine assailed the young doctor anew. Back-pressure, even on the showing of its strongest supporters, was a gradual process of disaster. His doubts were strengthened by a fresh experience which now befell him, and which he thus described:

"In one of my patients—a woman—the 'auricular paralysis' occurred in periodic attacks lasting from a few hours to a few weeks. I closely observed her during the attacks, and saw the signs of heart failure develop, with breathlessness, cyanosis (blueness) of the face, dropsy and dilatation of the heart. With the sudden reversion of the heart to the normal rhythm, all these signs disappeared in a few hours, and the patient would be able to be up and about her household duties.

I noted that the rate of the heart during the attack was always rapid, as well as irregular. I watched her for years, during numerous attacks, until the condition became persistent, with gradual drifting to death. I studied the effects of many remedies, and finally had the heart carefully examined *post mortem*."

Here, then, were the symptoms ascribed by the whole profession of medicine to Back-pressure actually coming and going with the coming and going of the Dangerous Type of Irregularity—that is to say, with the activity of the upper chambers of the heart. The moment the auricles ceased to beat, the patient became desperately ill; the moment the beating of the auricles was resumed, the picture of desperate illness vanished miraculously. Here indeed was a problem to set before the giants! Mackenzie concluded that failure of the auricles to beat embarrassed the beating of the ventricles, and thus brought about heart failure. The symptoms which were usually put down to Back-pressure, in fact, were due to lack of forward pressure, that is to say, to lack of driving-power in the ventricles or main pumping chambers of the heart.

This idea, which sounds commonplace to-day, was like a flash of inspiration in the year 1899. It directed Mackenzie's mind to what is, perhaps, the most fundamental fact in all medicine—*that the power of the heart depends on the efficiency*, i.e. *the unimpeded action, of its muscular walls, first, last, and all the time.*

Another surprise, however, was in store. It

was provided by a man whom Mackenzie had attended for rheumatic fever in the year 1883, when the patient was thirty-two years of age. The attack passed, leaving a systolic murmur ("*pff-dup*"), which the doctor accepted as a sign that the mitral valve, that is, the valve between the left auricle and the left ventricle, had been damaged. He watched the case carefully, fearing that shrinkage of the passage between auricle and ventricle might occur. And, true enough, in the year 1892, nine years after the attack of fever, a pre-systolic murmur was heard. Five years later, the patient suffered a bad breakdown from heart failure. He recovered, however, and in 1904 was following his trade as a mechanic. Mackenzie kept in touch with him and examined him from time to time. One day, to his great surprise, he found the man's pulse to be grossly irregular and also slow. The first, or auricular, wave had disappeared from the tracing of the beatings of the neck blood-vessels, and the pre-systolic murmur had utterly vanished. In other words, the patient was suffering from "auricular paralysis." The upper chambers of his heart had ceased to beat.

And yet he was wonderfully fit and well! Far from showing signs of heart failure, he was able to follow his heavy work all day, and even to work overtime with no undue fatigue! More astonishing still, the patient was not even aware that anything had gone wrong.

Mackenzie felt utterly bewildered, for this man, seven years before, had shown grave signs of heart failure, though his pulse was normal and

his auricles were in full activity. Now, when his auricles had ceased to beat, he seemed to be hale and hearty. How could this strange spectacle be reconciled with the idea—and the observed fact—that, in many cases, stoppage of the auricles produced, immediately, severe heart failure ?

Once again the doctor found himself " up against " a blank wall. There could be no sort of doubt that this case was a true example of the Dangerous Type of Irregularity—all the signs were present, most clearly marked. Yet the heart, though deprived of the activity of its upper chambers, was unembarrassed. There was no breathlessness ; there was no dropsy ; there was no blueness of the skin. . . .

A week passed, and suddenly the Dangerous Type of Irregularity ceased. The auricles began to beat again. Mackenzie then observed that the patient's pulse was 60 per minute. He looked at the tracings he had taken while the auricles were not beating, and saw that, during that period also, the pulse rate had been only 60. In other words, this case had differed from all the other cases of " auricular paralysis " which he had seen in the matter of pulse-rate. All the other cases of " auricular paralysis " had shown—when the paralysis supervened—a very rapid pulse. This case showed a pulse which was, relatively, slow.

" It occurred to me," the young doctor wrote, " that probably the heart failure in the other cases was due to the excessive rate of the ventricle, the ventricle being exhausted by a want of rest."

He found further support for that idea in the fact that the drug digitalis always afforded great benefit to these cases of "auricular paralysis," the pulse-rate of which it slowed down. If digitalis failed to slow the pulse, on the other hand, the patient, as a rule, drifted to death.

No sooner had Mackenzie grasped this idea, than he turned with eagerness to the study of what promised to be a useful method of treatment. His enthusiasm was now yoked to a practical issue, and burned with fresh vigour. If only he could forge a new weapon of healing!

He found that the majority of persons whose auricles have ceased to beat are highly sensitive to the influence of digitalis, which quickly, when given in large doses, slows their pulses down. Digitalis does not, however, set the auricles beating again. If they begin to beat on their own account, the sensitiveness of the heart to digitalis is immediately lost. At the moment the young doctor was not able to account for this curious state of affairs; but he was able to bring new help to many stricken folk.

"So long as the heart beat at a rate under 80," he declared, "these patients were pretty well; whereas when the rate exceeded 110, they gradually showed increasing signs of heart failure. I therefore tried in each case, how much digitalis was required to keep the heart in check, and was frequently able to regulate the dose to that amount which kept the rate under 80, and thus enabled the patients to pursue their occupations for years, though at a lower level than in health."

Thus was the blow which Mackenzie had been led by his researches and by his method of " wait and see " to anticipate, parried also by his labours. Not only had he discovered the nature of the Dangerous Type of Irregularity—the fact that it was due to stopping of the upper chambers of the heart ; he had discovered also wherein exactly lay the danger of it to its victim, and he had found a means of warding off this danger, in very many cases, during long periods. He could say with confidence that if, when the auricles ceased to beat, the pulse rate did not increase, the heart's efficiency was little or not at all impaired. In these cases the outlook was very good. The outlook in other cases, where the pulse had become rapid, depended on the effects of treatment by digitalis. If this drug was able to slow the pulse, a favourable issue might be expected for the time being at least.

As he contemplated these findings, Mackenzie knew that he had approached nearer to the object of all his labours—knowledge which should enable him to foresee the onset of danger, and perhaps to ward it off. But he realized also that the object was by no means as yet within his grasp. Heart failure, as he was learning, occurred apart from the Dangerous Type of Irregularity, apart from broken-down valves, apart from changes in the sounds and in the shape of the heart. Of what nature was this heart failure ? And by what signs could its earliest presence be detected ?

CHAPTER XX

SIGNS AND WONDERS

The work described in the last chapter involved hours of patient watching by the bedsides of patients who happened to be showing the Dangerous Type of Irregularity. It involved also the use of hundreds of strips of smoked paper to make the tracings. Mackenzie began to find the continuous smoking and varnishing of this paper a great burden, and a serious handicap in his studies. He desired most earnestly some form of pulse-writing machine which would work with ordinary paper and pens, and so require neither smoke nor varnish for its operation.

Happily Providence, in the shape of Mr. Shaw, watchmaker, of Padiham, a suburb of Burnley, came to his rescue. Mr. Shaw possessed genius; he realized exactly what his friend, the doctor, wanted, and he knew exactly how to fulfil that want. He set to work with zeal and diligence and produced that instrument which is known to-day the world over as "Mackenzie's Ink Polygraph," and which has been copied with greater or less success by almost every instrument-maker on earth. The Ink Polygraph is a piece of clockwork, by means of which a long roll of smooth paper is

made to travel at a rate of speed which is marked on it, as it travels, by a "second hand," a tiny pen also worked by clockwork. Two other pens write on the paper. They are connected with rubber tubes in the manner already described in such a way that a tracing of the pulse, and a tracing of the throbbings of the vessels in the neck, can be taken simultaneously. The pens carry their own "ink-wells," which are charged with red ink.

Mackenzie's delight in this instrument was very great. As he looked on its clean rolls of paper and shining pens, and compared them with the sooty strips he was accustomed to handle, he realized that a vast amount of unnecessary labour had been saved him. That, however, was not the chief advantage of the new Polygraph in his eyes. Its chief advantage lay in the fact that he could now easily take continuous tracings, tracings lasting not a minute or two but, if necessary, hours—for when one roll of paper was exhausted, another could be slipped on the machine. Thus, he would be enabled to make permanent records of the behaviour of the heart during periods of stress, during the continuance of bouts of abnormal beating and during times when danger, from any cause, was apprehended.

These expectations were fulfilled. The Ink Polygraph gave to its inventor everything which he had ever hoped to obtain from it. But it gave him also trouble and annoyance, exasperations the possibility of which he had not foreseen or even, indeed, dreamed of. As he stood in the watch-

maker's shop, above the bridge at Padiham, and gazed, for the first time, on this gleaming instrument which was destined to carry his name to the farthest borders of civilization, he little thought that it, and not the ideas it had been constructed to serve, would, in the minds of many of his professional brethren, be accounted his chief title to fame.

When he invented the Ink Polygraph Mackenzie—all unwittingly—invented also a symbol. He gave to his work a concrete expression, something which the vulgar might behold and handle; something obvious, new, curiosity-provoking; a toy for fools. The symbol, as so often happens, became more important than the work. It swallowed the work, so that people said, "This is the instrument which made Mackenzie's discoveries possible." All the heart specialists in Europe and America eventually bought Ink Polygraphs, and not a few of them seem to have thought that, in making this purchase, they were buying also the wisdom and the labour which gave birth to the little machine. It is one of the ironies of the pursuit of knowledge that Mackenzie, who denounced so vigorously the blind symbol-worship which his profession accorded to the Stethoscope, should himself have provided a new symbol, the worship of which has been equally blind and equally subversive of progress.

Some little time before he left London, he told me that there were occasions when he felt like flinging his Ink Polygraph out of the window, because it had attracted to itself so large a share of

the interest and attention which should have belonged to the great principles it had helped to elucidate.

We were walking down Harley Street at the time. Suddenly, he stopped and demanded:

"Has it ever struck you that the greatest enemies of a new idea are not those who oppose it, but those who find some concrete, tangible expression of it—something which may, in course of time, be made to mean anything, to express anything?"

I was not quite sure what he meant, and so I waited without answering him.

"That polygraph of mine," he said, "to go no farther afield, and its rich relation, the Electro-cardiograph, are now spoken of as instruments of precision far superior to the finger of the doctor on the patient's pulse. Men without wisdom say that I have made cardiology scientific with these machines, so that, unless you possess a machine—a whole battery of machines—you cannot take rank as a heart-specialist according to the Mackenzie pattern. . . . Think of it! And I have nearly abolished all instruments from my own practice." He paused, and then quoted bitterly, "'This wicked and adulterous generation seeketh after a sign. . . .'"

In his later years, he made very frequent references to these "signs" which, as he believed, had done so much to obscure his teaching and the teaching of others. He once said to me:

"Have you noticed how fond we all are, doctors and patients alike, of mystery and magic? They force us to be charlatans. . . ." He shrugged his shoulders, and I could see that he was somewhat annoyed.

"I had a man here just now," he added, "who demanded that I should take one of my 'famous electric pictures' of his heart. I told him he had missed his way, and that it was a conjuror he had evidently intended to call on. . . ."

Then, suddenly, he brought his hand down with a bang on his desk. . . .

"That is the sort of stuff that is being said about me! That is what the public wants! . . ."

A moment later, however, his manner changed, and the kindly smile I knew so well, broke on his face.

"If I had never invented the Ink Polygraph," he remarked, "I might never have obtained a hearing at all."

On another occasion, when a doctor informed him that he looked forward to the day when "instruments of precision" would replace the human senses, Mackenzie, with a sweep of his great arm, indicated a bowl of roses in a corner of the room.

"Can you smell them?" he asked.

The doctor looked bewildered. He said he could smell the roses. I have often wondered since whether or not he understood the lesson which was being taught him. Mackenzie's belief in the "unaided senses" was as strong as was his mistrust of "mechanical devices." It grew stronger

as, year by year, the results of his method of "wait and see" became available. Stronger, too, became his faith in the kind of knowledge which Dr. Briggs and the older physicians in Burnley and elsewhere possessed. He was beginning to understand those "indefinable impressions" which are conveyed to the senses of the trained observer by the linaments of disease. He gives in his book on *The Future of Medicine* two examples from his own practice of the application of knowledge of this kind, in the following words:

"I was once called to see a patient in consultation. When I entered the house I found the doctor there very sad and depressed, and he muttered to me, 'Too late.' I asked what was the matter, and he said that he had attended the patient in her confinement four days ago, and she had developed puerperal fever with a temperature of 103° Fahr. and was dying; that it was the first case in his practice, and he felt he was to blame. On entering the bedroom, the patient's face struck me as being bright, but very anxious; there was a red flush on her cheeks. When I felt her pulse, I looked at her and she was gazing at me in a frightened way. I smiled at her. She looked surprised and said, 'Doctor, am I not dying?' 'No,' I replied; 'you'll live to have a dozen babies yet.' She made a good recovery.

"A short time after, I was called to see another patient. I met the doctor, a clever young man, who had been five years in practice. He told me there was nothing to fuss about. The patient was confined a week ago, and there was a slight rise in temperature to 101° Fahr., but the patient's friends were anxious and troublesome, and he had

called me in to reassure them. When I entered the room I saw that the patient's face was very different from that of the last-mentioned patient. She was dull and apathetic. There was the faintest sallow tinge in a somewhat grey countenance, and the pulse was small. There was nothing else revealed in examination, and the doctor was incredulous when I told him that it was a case of puerperal fever, and that she would be dead in twenty-four hours—which turned out to be correct. No blood-count, no bacteriological examination of the discharge or the blood, no instrumental method of examination of the heart could tell me as much as a glance at the face and the feel of the pulse revealed."

At that period childbed was an ordeal fraught with terrible danger, and there were all too many opportunities of seeing the dreaded "childbed fever." Mackenzie commented:

"How was this knowledge acquired? At the time I entered practice, Semmelweiss' great discovery had not been utilized in this country, and it was after I had been a few years in practice that I became acquainted with it. During these years I had ample opportunity of observing puerperal infection. After I adopted the plan of thorough disinfection of my hands, a great change came in my midwifery practice. . . . Although I had but one death from puerperal fever in my own practice, I saw plenty of it in other practices. I was called to a distance once to see a woman who had been three days in labour. She was elderly, and a primipara. The doctor in attendance had tried to deliver with forceps and

had failed, and had called in two neighbours who also failed. I managed to deliver her, and left her looking very ill. Next day I was sent for to see her, as she was dying, but I could not go, and a colleague went in my place. She was sinking, and, unfortunately, he examined her. On his way home, he was intercepted by a man who took him to attend to his wife, who was in labour with her first child. Immediately after the delivery, the doctor was called to another primipara in labour, whom he delivered. A few hours later, he was called to attend a third woman in labour. Within a week these three women were dead. We studied them carefully, and examined one of them after death, but could find nothing beyond these signs of intense depression which ended in death."

I have given this tragic and dreadful story in Mackenzie's own words for two reasons. In the first place, because it reveals his attitude to any discovery which was capable of being used in practice. He was among the first to give to his patients the benefits of the work of Pasteur, of Lister, and of Semmelweiss, declaring that "there is no doubt that infections play an enormous part in the production of disease, and, that being so, laboratory methods are essential in their detection." But he knew, and this is my second reason for quoting that awful experience, that "there is great diversity in the response of individuals to microbic invasion." Mackenzie was no enemy of scientific medicine, as his opponents and detractors have so often declared. But he was concerned with the "Science of Medicine" first and foremost.

Other sciences, such as bacteriology, were, he believed, ancillary to this science where the treatment of patients was concerned.

The horror of puerperal fever—childbed fever—was that its virulence was so great that no strength of body seemed able to cope with it. The strongest fared no better than the weakest. This fact disturbed the mind of the doctor greatly, and he was further disturbed to know why, and of what, these poor women died. Granted that germs had gained access to their bodies, and granted that those germs were producing a most potent and awful poison, on what structures of the body did the poison act?

That question has not been answered to this present hour, which fact may or may not account for the still considerable mortality from childbed fever, and for the utter lack of any certain cure, once the disease has become established. Mackenzie made some efforts to supply an answer, but failed. He did, however, reach the clear idea that death was due, in each case, to inability of the heart to continue its work. Death, in short, was due to heart failure.

In other words, the poison from the wombs of these young women was potent enough to cause the contractions of the heart muscle, the beats, to stop within a few days or even hours of exposure to it. This, surely, was heart failure of a different kind from that observed in connexion with the Dangerous Type of Irregularity. Mackenzie's mind passed from the contemplation of irregularities of the heart to the far greater, and far more

difficult, question of heart failure. He put to himself, as was his wont, innumerable questions which had arisen in his thoughts during his daily work. Such questions as, " Why is heart failure, in some cases, a process attended by breathlessness and dropsy and blueness of the face and the Dangerous Type of Irregularity, ' auricular paralysis ' ? Why, in other cases, is it attended by severe pain on effort, without either dropsy or breathlessness or blueness or auricular paralysis ? Why, again, in other cases, does it come suddenly in the night, or in the street ? Again, why does it follow swiftly, in many instances, on the onset of childbed fever or pneumonia or other acute disease ? "

Though he felt himself utterly unable to answer these questions, he realized also, with satisfaction, that he had come to the core and centre of the problem he had set himself to solve. He told me once that everything in his studies of the heart seemed obscure and difficult and confused, until the day on which he asked himself the simple question :

" What is it that I fear in all these cases ? "

The answer came immediately :

" *Heart failure.*"

Heart failure, and not broken valves ; heart failure, and not the Dangerous Type of Irregularity ; heart failure, and not angina pectoris ; heart failure, and not childbed fever or pneumonia or typhoid. All these other troubles and symptoms might, or might not, lead to or conduce to heart failure. But in any case, *of themselves*, they were

not the real and ultimate object of concern. Their significance depended entirely on their relationship to, or effect on, the efficiency of the heart as a blood-pump. Here, at last, was a guiding principle.

CHAPTER XXI

HOLY GROUND

MACKENZIE proceeded to apply his new principle —*that a sign or symptom associated with the heart is significant only in so far as its presence indicates the onset of heart failure.* He asked himself at once, "Does the appearance of the Dangerous Type of Irregularity indicate the onset of heart failure?" His researches had already supplied an answer. In some cases, apparently, it did. But in other cases, clearly, it did not. This type of irregularity, then, could not be accepted as an unequivocal sign of heart failure. Even when the auricles had ceased to beat, heart failure (that is to say, failure of the ventricles) might not have set in.

Did the same thing apply to murmurs?

I have already tried to explain the nature of heart murmurs, and the manner of their detection by the stethoscope. I have indicated also that these signs and their interpretation were regarded, at the time when Mackenzie began to study them, as having been placed beyond all possibility of dispute or question. Mackenzie might form what opinions he pleased about heart irregularities—that was his own field, but when he dared to turn

to the subject of murmurs, he was trespassing on the preserves of others—of the giants themselves. *He was on holy ground.*

It had already been decided that murmurs were signs of the breakdown of valves, and that, when valves broke down, "Back-pressure" immediately began to manifest itself, unless, indeed, "compensation" had been established; unless, that is to say, Beelzebub, in the shape of the heart, was casting out the devil of his own "Back-pressure" by an added vigour of action! Mackenzie, however, was armed with a weapon of great and unsuspected potency—his method of "wait and see." He had waited and seen already that large numbers of people with murmurs in their hearts did not become the victim of heart failure but, on the contrary, remained active and vigorous. On the other hand, he had seen that large numbers of people who possessed no murmurs but had "clear" heart sounds, drifted to heart failure and died of it. He realized that a murmur cannot, of itself, be an unequivocal sign of heart failure.

But in this matter he could not afford to take even the slightest risk. The teaching he had received on the subject of murmurs was so definite, the giants were so insistent, that he felt that he must sift the matter to the very bottom before he dared to take the grave responsibility of giving advice to his patients of a kind different from that regarded as orthodox.

Accordingly, the method of "wait and see" was applied with special care to those patients

who suffered from murmurs. They were watched at all times, but more especially at times of stress, for example, during illnesses, during childbirth, and when engaged on very heavy work. In this way, the information conveyed by the stethoscope was tested and made significant.

And, as the event showed, there was much need for such testing. Mackenzie wrote:

"About one hundred years ago auscultation" (*i.e.* listening with a stethoscope) "began to be used to detect the sounds of the heart, and it revealed to the earliest observers that in healthy individuals the sounds were clear and well-struck, while in people suffering from manifest heart failure the sounds were not clear, but were muffled and modified in a manner which was described as 'bruits' (*i.e.* murmurs). At once the conclusion was formed that bruits were of a serious significance. This conception arose at a time when the cause of these bruits or murmurs was unknown. The outcome of this hasty generalization imposed on the profession a perverted and erroneous conception of the significance of murmurs which has permeated every part of the world where auscultation is employed, and to-day misleads the profession in all countries."

Here again, as Mackenzie soon perceived, an instrument which had become a symbol was the stumbling-block. There is no piece of the apparatus of the doctor which is, to-day, so closely identified with him as is his stethoscope. The public believe that this instrument reveals to its user the most remote secrets of the bodily

mechanism. They accord to it a species of veneration, and this worship is shared, in a manner, by the doctors themselves.

"The public," wrote Mackenzie, "have a great belief in obscure and tortuous methods. This is really a part of human nature, revealed in the untutored savage who, in his troubles, makes for himself a graven image to worship, and in the faith that, to-day, finds solace in elaborate rites and ceremonies. The public demand from the mysteries of medicine what they require in the mysteries of religion, and where there is a demand, there will always be those to meet it. . . ."

In short, when his study of murmurs was complete, Mackenzie found himself under the necessity of attacking the stethoscope, and, with it, all the mystery and veneration which it commanded. In place of the confused sense of terror which the detection of a murmur produced in most doctors' minds, he had won for himself a clear knowledge of the true meaning of murmurs. Just as he had learned by study, combined with use of the method of "wait and see," to distinguish the dangerous from the innocent forms of irregularity of the pulse, so he learned also to distinguish dangerous from innocent murmurs.

The murmur known as "pre-systolic," to which reference has already been made, is a case in point. This murmur is caused, as was pointed out, by shrinkage of the passage between two of the chambers of the heart. Such shrinkage reduces,

of course, the amount of blood which can flow from one chamber to the other in a given time. If it is very considerable in extent, it may therefore actually reduce the volume of the circulation to a point incompatible with life. If, on the other hand, it is not extensive, the interference with activity may be inconsiderable. Further, a shrinkage which is rapidly progressive, which, that is to say, is quickly getting worse, is necessarily a far more serious matter than a shrinkage which is progressing slowly, or which is not progressing at all.

Until Mackenzie began to examine this subject, however, these considerations do not appear to have received much—or indeed any—consideration. A pre-systolic murmur was a pre-systolic murmur. It meant the presence of mitral stenosis —of narrowing of the mitral orifice or passage. And that meant trouble. Consequently, when a pre-systolic murmur was detected by the use of the stethoscope, the patient was at once told that he or she had grave heart disease, and was forbidden to indulge in any strenuous exercise. The very idea of pregnancy was to be dismissed from the mind of every young wife so afflicted. The event, however—that is to say, the method of "wait and see"—showed that, while some victims of mitral stenosis fared very badly, others did not suffer to the same extent. Among these latter, indeed, there were people who continued to lead active lives, and there were women who passed safely through the ordeal of childbed. Obviously, then, mitral stenosis could not, of itself, be regarded

as a certain sign of heart failure, or even of impending heart failure.

Mackenzie had already noticed that the pre-systolic murmur, which indicates the narrowing of the passage in the heart, never made its appearance during the first attack of rheumatic fever. At that period, as he now realized, the walls of the passage are inflamed and injured, but shrinkage has not yet begun to manifest itself, nor can do so until the inflammation begins to die down and scars to form. Following this clue, he consulted his case records, and found that the time between the first attack of rheumatic fever and the first appearance of the pre-systolic murmur varied greatly in different patients. In some cases, for example, the murmur would appear within a couple of years, and be joined by a fainter murmur filling up the whole period between the beats of the heart, so that, in four or five years the evidences of a very extensive narrowing would be present. But, in other cases, only a very faint pre-systolic murmur would be audible after ten or twenty years. Manifestly, the outlook in the former type of case is very grave, whereas the outlook in the latter type is not very grave. As a result of his study, Mackenzie was able, in certain cases of this universally dreaded disease, to advise his patients to carry on their lives without special precaution. He was able, in other cases, to foresee disaster and, by his foresight, to mitigate its severity. He wrote:

"In a case of pregnancy, the question whether the heart may be fit to bear the strain may depend

on the extent of the embarrassment offered to the blood-flow by the narrowed orifice, so that the degree of narrowing, and the rate at which it is taking place, are questions of prime importance. Nevertheless, even in the most recent literature there is shown no realization of the importance of this matter, nor any hint that there are signs which afford this necessary information."

Mackenzie, in other words, devised for himself a method of making the pre-systolic murmur tell him whether or not heart failure was to be feared as an immediate danger. He judged the murmur solely in terms of its relationship to heart failure. Thus he reduced the stethoscope from the position of a lively oracle to that of an humble servant. The stethoscope might enable him to hear the murmur or murmurs; but at that point its office ended. The task of timing the murmur in relationship to the first attack of rheumatic fever, and of co-ordinating this information with the other signs and symptoms presented by the case, was the real difficulty.

Very often the solution of this difficulty discounted, to a great extent, the information which the stethoscope had conveyed—as, for example, when the pre-systolic murmur was found to have remained slight and undeveloped during a period of fifteen or twenty years.

Compare this clear-sighted attitude with the blind anxiety which characterized practically the whole medical profession up till the close of the last century and which, even yet, has not been completely dispelled! The Burnley doctor was

able—in the end—to separate the more serious from the less serious cases of every form of valvular disease, because he had been at pains to recognize that what mattered, in the last issue was not a broken-down valve nor a narrowed passage, but the effect of one or the other, or both, of these on the power of the heart. This is exactly the information which the stethoscope is incapable of imparting. It was, consequently, exactly the information which the majority of heart specialists lacked. Thus, when Mackenzie came to Harley Street and boldly pronounced this murmur dangerous and that murmur unimportant—in utter defiance of the orthodox teachings of the day—even his well-wishers held their breaths. Such daring suggested a degree of imprudence which must surely lead, sooner or later, to disaster.

These timid folk did not know their Mackenzie—the man of Burnley—who "testified that he had seen." They did not know the method of "wait and see." They did not realize that the heart specialist of 133, Harley Street was the general practitioner of yesterday, the man who had done most of his own surgery, and all of his own midwifery; who had watched and waited, year in and year out, the while he studied, by means of his own wonderful devising, every attitude and every complexion of disease.

How little the deep sources of Mackenzie's strength were realized, even by his intimates, I had many occasions of learning. Those who were not intimate with him never seemed even to suspect them. I remember an incident which

opened my eyes to this curious ignorance. A party of Americans were being conducted over a certain hospital by Mackenzie. He told them some stories of his early life and mentioned, casually, a maternity case which he had attended. One of the visitors remarked:

"I suppose, Sir James, you mean that you were called in, as a heart specialist, to see the young mother."

Mackenzie turned, and for a moment gazed at the man in blank bewilderment. Then he ejaculated:

"*I was the family doctor.*"

I shall never forget the tones in which he pronounced these words, nor the effect which they produced. So, probably, did Napoleon speak his famous rebuke to the Austrian diplomat:

"*When I had the honour to be a lieutenant in the artillery.*"

His study of mitral stenosis and of the other valvular diseases of the heart, convinced Mackenzie finally that murmurs were of themselves quite unreliable as indications of heart failure. He had come to the same conclusion about irregularities of the pulse. Where, then—since both the stethoscope and the polygraph had failed him—was he to find a reliable means of assessing the heart's efficiency? He did not know.

"I felt," he wrote, "inclined to give up in despair. . . . I was struck with the resemblance of myself to one of the characters depicted by Bunyan in his *Pilgrim's Progress*. He describes a man earnestly engaged in raking the mud in search of

something he was not quite clear about, while above his head shines the crown of glory which was the real object of his research. I felt like the man with the 'muck-rake,' and I felt certain, if he were addressed in modern terms, the conversation would be somewhat as follows: Asked what he was doing, he would reply he was collecting stones and twigs and straws. If it were suggested that this seemed a vain quest, he would reply that he was discovering new facts and, as a new fact was an addition to the sum of human knowledge, the quest was therefore justified. Moreover, he might add, 'I am the first to introduce scientific methods in this research, as I weigh the pebbles and measure the stones.'"

The straws and pebbles in this case were the signs and symptoms which Mackenzie had studied, but which did not afford him any real clue to the mystery of heart failure. He included, that is to say, some of his most brilliant researches in the scornful denunciation "muck-raking." They were "muck-raking" because they had been pursued without a guiding principle. Had a guiding principle not ultimately been found, they must have remained mere straws and pebbles; a bunch of tracings without meaning or significance in the actual practice of medicine. Happily, just when he had despairingly concluded that no sign presented by the heart could be accepted as a reliable sign of heart failure or of heart efficiency, an experience in practice gave him the clue he had so long and so diligently sought. I give this experience in his own words:

"I remember examining repeatedly a man suffering from angina pectoris, and failing to detect any physical sign of disease; yet he could not walk two hundred yards without being pulled up by an excruciating pain. When he died, I found the myocardium (heart muscle) extremely atrophied (wasted) and the coronary arteries (arteries which feed the heart itself) blocked. I saw that this condition must have been coming on for many years, and this caused me to reflect on the effects of the damaged muscle. When the man was at rest he was quite well, mentally active, and complained of nothing, but when he made an effort he was pulled up.

"So I dimly conceived that the symptoms were only produced in response to effort. Then I considered the nature of the heart's functions, and recognized that the muscle-force of the heart could be considered as being of two kinds, one to maintain the circulation when the body was at rest, and the other a reserve force, called into play when an effort was made. On reflection, I recognized that the first sign of heart failure was bound to be a diminution of this reserve force, and that the earliest symptoms of heart failure would be shown in a response to effort.

"I therefore made a long investigation into this response to effort, considering first what happened to people in health. In childhood the response to effort is small, for the child stops after running a few yards. In boyhood it is much greater, and reaches its greatest amount in the heydey of youthful vigour; after that, it gradually declines, till the old man reaches the limits of his childhood. I compared these results with what happened in disease, and found that the response to effort was restricted in exactly the same way.

Then I asked, 'What are the signs of this limitation?' . . .

"It occurred to me to ask of the individuals, healthy and ailing, 'Why have you to stop?' They all replied, 'Because of a feeling of distress.' This gave a new turn to my inquiry, and I then investigated this sensation of distress. At first it was difficult to get a clear conception, for I was too ignorant to ask the suitable questions, and too ignorant to interpret the answers. After a time I got a little understanding, and gradually the nature of the distress became perfectly clear. The reason why I failed, and indeed why the medical world fails to-day, to understand the symptoms of heart failure, is because of their extreme simplicity. When we search for the recondite and the obscure, we fail to recognize the simple and the obvious.

"The sensations of distress which indicate the limitation of the heart's power are of two kinds—breathlessness, with its associated phenomena, and pain, with its associated phenomena. When you come to think of it, a failing organ does not itself necessarily show its impaired efficiency; rather, the symptoms will be shown by the organs which are affected by the diseased organ's failure. Health is the harmonious working of all the organs. The disordered or impaired function of one organ upsets the others, and the signs of ill-health are found, not in the inefficient organ, but in the others."

CHAPTER XXII

THE METHOD OF THE "TRUE SCENT"

THE "muck-raker" had glanced up and seen the angel with the crown. At last, as he says himself, Mackenzie had *realized*, and not merely stumbled upon, his guiding principle.

He had realized that the two great methods of research which he had been pursuing were not enough: that neither of them could ever lead him to the goal of his labours, the power to foresee and prevent danger. A third method was absolutely necessary.

The method of "wait and see," for example, could be trusted to show, in course of time, that certain signs and symptoms were not serious. That had already happened in the case of the Youthful Type of Irregularity of the pulse, and in the case of the Extra-systole. It was also happening in the case of certain of the murmurs of the heart. But the method of "wait and see" could not be trusted entirely when symptoms of danger showed themselves. The case of the Dangerous Type of Irregularity proved this. A large number of patients died soon after this irregularity showed itself. On the other hand, some patients went on working well at strenuous occupations for years after it had appeared.

Nor did the second method of research, the method of discovering the mechanism of symptoms, offer much help in this difficulty. Mackenzie had found that the Dangerous Type of Irregularity is due to the sudden cessation of the beating of the upper chambers of the heart—a piece of research work the brilliance of which was soon to dazzle the world. But this discovery did not supply the answer he was seeking. It did not tell him how to recognize the onset of heart failure. Indeed, all he knew from the combination of the method of "wait and see" and the method of discovering the mechanism of symptoms was that the Dangerous Type of Irregularity represented a paralysis of two chambers of the heart, and that it might or might not be followed by heart failure. It was this "*might or might not*" which so greatly distressed him. He was looking not for possibilities, but for certainties.

Let the reader suppose—to borrow an idea from Mackenzie himself—that a doctor set out to discover why men and women died, and, having noticed that many persons on their death-beds had white hair, devoted himself first of all to a study of this "abnormality." Applying the method of discovering the mechanism of symptoms, he might find, as has indeed been found, that the greyness of the hair is due to the activities of certain of the white corpuscles of the blood which carry away the colouring matter from the hair-roots. Applying the method of "wait and see," he would find that numbers of grey-haired men and women die after becoming grey, but that,

on the other hand, numbers do not die, but live actively for many years. These discoveries—as Mackenzie so clearly perceived—would lead the investigator nowhere at all. He might know something about grey hair; but he would know nothing about the reasons of death, the original object of his research.

And why? Because, in point of fact, life is not dependent on the colour of the hair for its vigour or duration. In other words, grey hair, in this case, is a "false scent." Mackenzie realized that the first step in all research work is the finding of a "true scent," and that without this the knowledge obtained can be of little or no use to the "hunter" in enabling him to come up with his quarry. Had the student of grey hairs realized that life is not dependent on grey hairs, he would not have pursued his labours in this direction at all.

In studying irregular action of the heart and murmurs, Mackenzie had been, as he saw, on a "false scent," seeing that the object of his research was the power to foresee danger. Danger did not lie in irregularity of the pulse, *per se*, nor in murmurs *per se*, but in failure of the heart muscle to perform its work. Nor was the presence or absence of these abnormal signs any unequivocal indication of the presence or absence of heart failure. The "true scent" came when he realized, from his examination of patients, that the signs of heart failure are likely to be shown not in the heart itself, but in the organs supplied with blood by the heart. In other words, the method

of "wait and see," and the method of discovering the mechanism of symptoms are, alike, of small practical value until they have been brought into harmony with the third great method of research, the method of the "true scent" or guiding principle. "For want of a guiding principle," said Mackenzie once, in my hearing, "I spent years and years in 'muck-raking.'"

Thousands of his professional brethren grasped Mackenzie's method of discovering the mechanism of symptoms, and it is on this method that his fame to-day principally rests. Large numbers, too, understood the method of "wait and see," though few seem to have realized its importance. But scarcely anybody appears to have grasped the third method, the method of the "true scent," or to have perceived that it is this great man's greatest contribution to the Science of Medicine.

And the reason is plain enough. To say that a research worker should follow a true scent, is like saying that a ship should be steered for the port to which it is bound. The whole world agrees. What the world, however, does not see, is that it is one thing to say, and another thing to do. Mackenzie set out to reach a definite goal, a definite piece of knowledge. He made some interesting discoveries, but nevertheless failed utterly to achieve his object for many years, simply because he had failed to strike the true scent. Who will deny that a vast mass of present-day research work is lying under the curse of the "false scent"?

The "true scent" in the study of heart affections was, Mackenzie now clearly saw, the response of the organ to calls for effort. This was the real measure of the heart's efficiency, of its strength and also of its failure. It was, too, the real measure of the significance of any signs or symptoms which might be present. Thus, a murmur which did not influence unfavourably the response of the heart to effort, might be discounted as a serious sign, provided that the method of "wait and see" had revealed that the murmur was not an indication of a progressive condition.

The response of the heart to effort could, Mackenzie found, be ascertained from the statements made by the patient himself about his own sensations. It could be ascertained in no other way, because the response to effort of every human being is peculiar to himself or herself. What signifies is not, for example, the fact that a man feels breathless on ascending the stair of his house, but the fact that this breathlessness is a new manifestation in his particular case. In the same way, the fact that a man is "pulled up" by a pain in the chest when he begins to walk, is less important than the fact that, week by week, the distance which he can walk before the pain seizes him, grows shorter. Both the breathlessness and the pain, in these cases, are signs of progressive inefficiency of the heart; *they are signs of a change* for the worse.

Mackenzie found enormous difficulty in getting his professional brethren to understand his work

on the response of the heart to effort. Indeed, shortly before his death he wrote:

"You can see the failure to grasp it"—the significance of the response to effort—"in the medical forms for life insurance. Questions are asked about the size of the heart and its sounds, its rate and its rhythm, but not a single question as to the response to effort. . . . I have on many occasions been consulted by men who had, a few months before, been insured for large sums, who suffered from such advanced disease of the heart that they died shortly after. There was no physical sign, but their replies to my inquiries as to their response to effort revealed the extreme gravity of their condition.

"It requires much experience to use this method, but when the knowledge is acquired, it is easy. The testing of a patient by hopping about a room and counting his pulse and taking his blood-pressure cannot reveal this information; it is got from the patient's experience when the heart is called upon to do its usual work—such as walking up a hill after a meal, walking in the cold air, and so forth. The reason I mention this is to indicate that artificial tests do not bring out the qualities of an organ, either in the case of the heart, of the stomach, or of the kidney, or of any other organ."

Mackenzie had applied the methods of "wait and see," and the discovery of the mechanism of symptoms to heart irregularities and to heart murmurs; he now applied these methods of research to the response of the heart to effort, and to the two symptoms which commonly indicate,

both in health and disease, that this response is flagging—breathlessness and pain over the left side of the chest. He soon found that, when the "scent" is true, the search is easy and productive. The power to foresee danger, which he had so long desired to possess, was given to him at last.

CHAPTER XXIII

THE POWER TO FORESEE

His discovery that its response to effort is the measure of the heart's efficiency, directed Mackenzie's thoughts to those symptoms of distress in effort of which so many of his patients complained: breathlessness and pain over the chest. He soon found that he had become possessed of a new power. He was able, at last, to foresee danger, and so to guard against it.

"A young wife was brought to see me," he told me once, "soon after I had realized the importance of the response to effort as a test of the heart's efficiency. She told me that a doctor had informed her she had heart disease, and had warned her that she must not, on any account, have children. I found that she had a presystolic murmur, the consequence of an attack of rheumatic fever contracted ten years before, in childhood. The murmur was unaccompanied. She felt strong and well, and had noticed no reduction in her power of getting about and doing her work. Neither breathlessness nor pain afflicted her while engaged in ordinary tasks. I told her she might safely have children, basing this opinion on the fact that the heart's response to effort was in no degree embarrassed by the

presence of the slight and evidently unprogressive mitral stenosis. She became the mother of a healthy child some two years later, and suffered no ill effects from her confinement."

Mackenzie went on to point out to me that his three methods of research had each played a part in leading him to his conclusion. Thus he could not have given any opinion at all had he not known the true measure of the heart's efficiency (*method of the true scent*), and he could not have discounted the pre-systolic murmur which had so frightened his professional colleague had he not understood the mechanism of this sign (*method of the discovery of the mechanism of symptoms*), and known (*from the method of "wait and see"*) that in the form in which it presented itself it was not of grave import.

He told me another story to emphasize his point.

"A woman came to see me because she proposed to get married, and wanted to know if she was strong enough to bear children. She was thirty-five years of age. I found no abnormal sign in the heart, but I learned from her that she had been growing more and more breathless on exertion during the last few months. I advised her that she was not fit to incur the strain of childbed. She took my advice. I heard some time ago that she was still alive, but that she was compelled to live a very careful and restricted life."

Breathlessness and pain, the symptoms of failure to respond effectively to effort, are not

heart symptoms at all. They are produced outside of the heart, in the lungs and the nervous system. The realization was thrust suddenly on Mackenzie that the exclusive study of any one organ must always, from the point of view of the doctor in practice, be a "false scent." The organs of the body, as St. Paul so clearly perceived, but as the majority of medical specialists do not perceive, are interdependent. Mackenzie turned to his notes of cases, and made a new and careful study of the histories of those of his patients who had suffered either from pain in the chest or from breathlessness. Further, he kept watch on the patients who showed these signs, just as he had kept watch on patients with irregularities of the pulse and with murmurs. I quote from one of his more recent accounts of this work :

"One object I had in mind was to understand where lay the danger of pregnancy in a woman with a damaged heart. This is a problem which confronts, time and again, every general practitioner, and it is one of very serious moment to those concerned. The references to this subject in the most recent books on obstetrics have not advanced beyond those published over forty years ago. To undertake this part of the inquiry I had, as I have said, first to train myself to detect the early signs of heart failure. Then I had to study the changes in the circulation, and search for the causes producing them, during pregnancy, during confinement, and during the puerperium, which occurred in healthy women ; I had to watch the changes that took place in women with different forms of heart disease, examining them before

pregnancy, and at all the subsequent stages. This meant attending them during labour, taking careful observation during the pains, and when free from the pains. These observations were not made in a comfortable ward with plenty of help, but often after a hard day's work, during the night, in poor cottages where I had to do the duties of doctor and nurse, give chloroform, apply the forceps."

He worked unsparingly, and, as a consequence of his work, acquired a new knowledge of the nature both of breathlessness and of pain. This knowledge, which is his great legacy to his profession, is already leavening the whole lump of clinical science—the Science of Medicine.

CHAPTER XXIV

FATHER AND DAUGHTER

MACKENZIE had need at this time of the encouragement which the acquisition of the power to foresee gave him, for troubles great and small were being laid on his shoulders. Two daughters had been born to him, and the elder of these, while still a very small child, suffered a severe illness. As he beheld the course of this illness, the young doctor realized, with new and poignant intensity, his ignorance and his impotence.

It was the first meeting which he had had with that profound distress which belongs to the intimate life of men and women, and is evoked only by the misfortunes of those they love, as a rule only by the misfortunes of wife or husband or children. I do not know how, in the deeps of his spirit, he regarded this encounter, for he never spoke of it in my hearing. But I knew that what illness had taken from his daughter he restored to her with a rare and beautiful and most sincere affection. And I know that her affection for him was one of the mainsprings of his happiness. He told me this on many occasions, though, in fact, there was no need for any telling. And so I think sometimes that out of pain and distress there

came to this true and brave man a consolation which only that pain and that distress, his and his daughter's, could ever have bestowed. And I think, also, that the fine courage and cheerfulness with which his daughter bore and discounted the effects of her illness, gave him great joy and rest. It was his own indomitable spirit which he beheld, face to face with a greater problem than any which he had been compelled to solve. He paid "Dorothy" the highest compliments of which he was capable, by expecting that she would live a full and active life, in spite of the disability which that early attack had laid on her. And not once did she disappoint him. No father ever tasted a purer joy than came to him when her etchings were accepted for display at important exhibitions in London and Edinburgh, and no man ever accorded a warmer meed of admiration to the bravery of woman than he did when his daughter learned to drive her own car, and took him through the densest traffic of London streets. Miss Mackenzie has been so very kind as to write me a letter about that car, and the part which her father played in connexion with it. She says:

"He told me to get into the car one morning, after it had just arrived, and to drive it out of the shed. (I had been down to the garage, and had been told to sit in the car, practising changing the gears for some few hours. The man at the garage didn't think of letting me out on the road for some time to come.) However, Father had other ideas. I got into the car, and he told me

how to start it, standing outside, by my side, and I did get the thing out—after banging in a mud-guard. I was dreadfully upset at this accident, but Father said it didn't matter, that I shouldn't make that mistake again, and just to go on. So on I went, round the garden and up the drive, and after various adventures, got it back into the garage. The next day Father got into the car, and he and I proceeded to go round the lanes, and I do assure you that no one else on earth could have made me do it and encouraged me as he did—mind you, it was when he had begun to have those dreadful attacks, too" (of angina pectoris from which he died), "and I was in terror lest I should cause him to have one. But he was never nervous in his life, and he never felt any sensation of pain from that kind of cause. I only tell you this to try, feebly, to give you a picture of what he was over every subject, apart from medicine."

This was not the first motor-car in which father and daughter had driven together. I quote again from Miss Mackenzie's letter:

"I remember always going on his rounds with him (at Burnley), first in a victoria of our own, and then in the first motor-car to be seen in Burnley. It was always going wrong, and getting too hot; or the belt slipped, or the engine wouldn't work, and on one occasion it stopped on a hill just at twelve o'clock, when the children came out of school. They hooted and cheered and helped to push it up the hill, and my Father's fury passed all words. He said more bad words about that old car than ever he did in the rest of his life. After he got sick of it and had sold it, he went about in a hired hansom cab.

"I don't remember to have seen him wait outside any patient's door. He always rang and knocked and walked straight in. He used to be pretty quiet on his rounds, and he used to draw his brows together and think and talk to himself very often, and after operations at the hospital he was very exhausted-looking and tired. He was never late for an appointment. The people next door said they could tell the time of day by our dinner-bell. At most of the houses he visited, he'd only be in a few minutes, but at some of them, when he took in his polygraph, he would be an hour or more. . . ."

It is possible, I think, to detect a plaintive note in that last sentence, and no doubt there were occasions when the little girl in the carriage eyed the polygraph without enthusiasm, and hoped inwardly that it would not be "taken in" that day. If so, however, I am sure that her father never guessed it.

"He was never too busy," she has written, "or too tired to help me and my little sister with our lessons at school, and we used to tell him all our experiences, and he had the faculty of listening and encouraging. Up to the very end of his life, he would put down his own writings to listen to our petty domestic troubles, and he did love his home, and he took such an interest in every single thing round about him."

Then there comes this confession:

"Though he was such a devoted father, I never once remember getting a welcome when I, very occasionally, opened the front door to him

when he came home from anywhere. He invariably met me, with a disappointed face, and said, 'Where's your Mother?' She was either ill or out, if she wasn't there herself."

His daughter's illness brought Mackenzie into close contact with Dr. James Ross, of Manchester, who was his friend. This able and observant physician had been making a careful study of pain, as it occurred in the abdomen, and had published a paper on the subject. Ross's work interested the Burnley doctor profoundly, the more so that he had now come to recognize pain in the chest as one of the cardinal symptoms of failure of the heart. Ross was a wide reader of scientific literature, and had pondered deeply the work of Gaskell of Cambridge, that great and inspiring pioneer. Thanks to this study, he had come to the conclusion that abdominal organs gave rise to two different kinds of pain: a pain felt in the organ itself, for example, in the stomach, and another pain felt at the surface of the body, in the skin or muscles.

With his mind set on the heart, which, after all, is a hollow organ, Mackenzie began to re-examine the matter. He came to the conclusion, from a study of his case notes (method of "wait and see"), that there was no need for this separation of abdominal pain into two kinds, and he further began to suspect that all pain is felt at the surface of the body, and not in the actual organs. He discussed this view with Ross, who could not accept it. So Mackenzie, with his usual enthusiasm, began to test the matter for himself.

Having been called to see a patient with an ulcer of the stomach, he got this individual to "define clearly where the pain was felt." He made a note of this spot. Then he got the patient to draw a deep breath, and so, of course, to alter the relationship of his stomach to the surface of his body—for the stomach moves up and down during breathing. *The pain did not shift at all.*

It could be said, then, that the place where the pain from an ulcer of the stomach was felt remained the same, no matter how the stomach might be moved about. This was a very surprising discovery.

"Although," Mackenzie wrote, "the great physiologist, Heller, had shown, one hundred and fifty years before, that the organs of the body are insensitive to mechanical stimulation (*e.g.* touching), yet this fact had never been appreciated by clinical observers, and at the time that I began this investigation, the belief was universal that the organs were supplied with sensory nerves (*i.e.* nerves of feeling) just like the skin. The proof of this seemed incontestable, because, on pressure over the different organs, pain was frequently experienced, so that, in those days, physicians and surgeons spoke of 'a tender stomach,' 'a tender spleen,' 'a tender liver,' 'a tender gall bladder,' as if such statements were beyond dispute.

"Ross's conception gave me a definite guide, and I seized every opportunity of noting carefully all the features of pain, paying particular attention to the circumstances under which the pain occurred, its manner of onset, the place in which it appeared, the parts into which it spread, and the

phenomena which accompanied its presence. While taking these steps, I found that it required a great deal of training to enable me to get the information I wanted out of the patient. Notwithstanding the clamant nature of pain it is extraordinary how difficult it is to get the kind of details I required. Patients who suffer much from pain are so accustomed to the symptom, that they have formed their own ideas about it, and confuse it with other sensations—*e.g.* 'a sickly pain. . . .' I therefore made special observations of patients when actually suffering, and if operations had to be performed in any of these cases, I was careful to see whether the places where the pains had been felt bore any relationship to the organs actually found to be diseased or inflamed."

This laborious work confirmed the idea that pain is not felt in the organs of the body, but in the skin. It suggested, further, that each organ is connected by nerves with some definite area of skin, which may or may not be situated "over" the organ, and that it is this area, and no other, which "feels" the pain.

Just when he had arrived at that conclusion, Mackenzie was called to see a man suffering from the trouble known as gall-stone colic, a severe form of pain caused by the passage of a large gall-stone through a narrow tube of the body, the bile duct. The man gradually got well. He called later at the doctor's consulting-room to report progress, and then Mackenzie noticed that he was holding his right arm stiffly away from his side.

"Why," the doctor asked, "are you carrying yourself in that fashion?"

"Because the skin on my right side is so tender that I can scarcely bear my clothes to touch it."

Mackenzie asked him to strip, and found a large area of exquisitely sensitive skin just where the pain of the gall-stone colic had been felt. It was a clue of a most valuable kind, for it led to the discovery that areas of skin tenderness are commonly present when organs of the body give rise to pain. It also explained why people wince when their doctors "press" over various organs; the organ is not tender, but the skin is. Further, the discovery followed that the muscles under the skin often become hardened when the skin is tender—and thus, no doubt, help to shield the inflamed or injured organ. It is interesting to realize that these observations of Mackenzie have recently been studied and carried farther by a distinguished surgeon who has shown that most valuable information about the health of bodily organs can be obtained by lightly pinching the skin of the body. This surgeon has confirmed Mackenzie's view that every organ has its own "patch" of skin, and that these patches occupy the same positions in all individuals.

But though the pain was felt in the skin, it was evidently caused in the organ. An ulcer of the stomach is an ulcer of the stomach. How was it caused? Once again, Mackenzie's own practice supplied the answer.

It became necessary, one day, to operate on a man who, however, stoutly refused to take chloroform. The operation began in an atmo-

sphere of considerable anxiety, for Mackenzie felt that when the actual handling of the bodily organs began, the patient might be much distressed. Nothing of the sort! The only thing which hurt the patient at all was the cutting of his skin. A piece of bowel had to be removed, and this removal occasioned no pain, nor indeed any feeling of any sort, in spite of the fact that it involved both cutting and stitching.

On the other hand, it was noticed, as the operation proceeded, that each time a wave of natural movement passed over the bowel, the patient experienced pain. But he did not experience the pain in the bowel itself. He felt it in the skin of his abdomen.

"Here," says Mackenzie, "before my eyes, was the undoubted cause of the pain, situated at some distance away from the place where the pain was felt."

In other words, bodily organs are insensitive (a blessed thought when the hangings, drawings and quarterings of the barbarous past are remembered!) so far as touching or handling is concerned. They do not become tender. But when excessive demands are made on them—for example, the strain of trying to move a gall-stone forward—and their own normal activities are, in consequence, strained, they send out "messages of distress" into the nervous system, which are felt as pain in certain areas of the skin—the special patches connected with these organs.

Mackenzie lost no time in applying this new knowledge to the pain occurring in the left side of the chest in many cases of heart failure. He

conceived that this pain must be due to the desperate attempts of the heart to cope with a load of work in excess of its powers (for example, during exercise), and he perceived that the time of onset of the pain after effort had been begun, and its relation to the character of the effort might be made to furnish valuable information about the state of the heart muscle. Obviously, a weak heart must "feel the strain," and so begin to send out messages of distress at a very early moment. A stronger heart, on the other hand, would not feel the strain so soon. It is to be noted that in many cases of angina pectoris, a characteristic area of tenderness of the skin is present after the attack of pain has passed.

CHAPTER XXV

THE AWAKENING OF THE GIANTS

"THERE are three stages in the history of every medical discovery," Mackenzie told me once. "When it is first announced, people say that it is not true. Then, a little later, when its truth has been borne in on them, so that it can no longer be denied, they say it is not important. After that, if its importance becomes sufficiently obvious, they say that anyhow it is not new."

He was speaking with a twinkle in his eye, but I knew that his own experiences lay behind this statement. He added, after a moment:

"All my early papers and writings were refused by the leading medical journals. Years passed before I could even obtain a hearing."

Mackenzie bore the editors of these journals no ill will for this early neglect of him. He had not expected that the views of a general practitioner would be presented to the great world. With singular modesty, he sent some of his papers to a local medical journal circulating in the North Country, and counted himself happy when they appeared in its pages. They attracted little or no attention. Thus it happened that, at a moment when the complete elucidation of some of the

most baffling secrets and mysteries of the heart was actually lying printed on obscure shelves, the giants of the profession remained lulled in the comfortable belief that knowledge about this organ and its diseases was complete. They taught their cut-and-dried doctrines about back-pressure and "compensation," and the dangers of murmurs to admiring students, and they dispensed the fruits of these doctrines to patients, not less impressed by their capacities, in their consulting rooms. "The Man of Burnley" saw and set his teeth. The truth began to dawn on him that if his discoveries were to be made available to his professional brethren and to the world, he must himself carry them into the strongholds of the giants.

That idea seems to have entered his mind first about the age of forty-five, just when his studies of irregular action of the heart were nearing completion. At this time he had acquired a considerable local reputation among general practitioners, and was being called out a good deal in consultation both in the immediate neighbourhood of Burnley, and also in districts more remote. He had, further, addressed a number of local medical societies, and had delivered a paper in Manchester, where he had been favourably received. But these, as he saw clearly, were no more than parochial successes, whereas the message which he had to deliver was for the ears of the world. It became, from this time forward, his sincere conviction that the world had need of his message.

Some visits which he paid to London and to the Continent confirmed him in this view. He found that the true nature of heart failure—as he had come to realize it—was not understood by heart specialists. These excellent men seemed to be unaware, even, of the need of such knowledge. They acted on opinions which the Burnley doctor knew as a positive fact were mistaken opinions, gross errors. They viewed with grave anxiety cases which he regarded as trivial, and they classed as trivial other cases which filled him with uneasiness. He was no longer willing to bow to such opinions. He had tested them in long days and nights, in a hundred humble homes, in the factory, in the workshop. And he had found them wanting. To have accepted them merely because they were endorsed by superior authority would have been to sin against the light that was in him ; to have retired from the field, now that the truth had been given to him, would have been to play false to the sick and suffering to whose service he had dedicated his life. Mackenzie realized that he had got to fight—that, for the sake of his own soul, he must join battle with the giants.

His first definite step in this direction was the publication in the year 1902, when he was forty-nine years of age, of his book *The Study of the Pulse.* A book differs from a paper or article in this respect—that is does not require the consent of an editor before it can see the light of day. And the publishers of medical works are far less under the influence of the " prevailing opinion " than are usually the editors of medical journals.

The latter are doctors themselves, and are usually obsessed by the idea that they must, at all costs, maintain their reputation for wisdom and gravity. Publishers, on the other hand, are men of the market-place, with an instinct for business. They continually take risks in the matter of new and unorthodox books, which do them great credit. Mackenzie, like many another man, reached the public whom he sought to influence, behind the backs of the "Press."

It is a fact which deserves emphasis. Every student of the Press, whether general or technical, knows that the reputations of newspapers are made in active conflict with authority. It is the papers which dare, in the name of humanity, to defy the giants, which live and grow strong and exert influence. This lesson is always being enforced. It is too often neglected. Thus a paper which, in the beginning, was nurtured on intelligent opposition to the powers-that-be, frequently grows respectable and dull, echoes the views of authority, or becomes their apologist, and dwindles to insignificance, its place being taken by an organ the "violence and vulgarity" of which strike terror and dismay to polite hearts.

It so happened that when Mackenzie began to write, some of the more influential of the medical newspapers were entering on a prolonged period of that kind of good behaviour which makes some schoolboys popular with some schoolmasters. Butter would not have melted in their mouths. A general practitioner with a theory of his own, which conflicted with the prevailing doctrine,

had about as much chance of entry to those journals as had a naked savage of supping with the Byzantine Emperor. Harley Street would not have liked it. The giants might have frowned.

Mackenzie's book went forth unperceived by the giants. It soon came to the hands of men who were truly interested in the message which it contained.

"It is," wrote one of his own partners in Burnley, "a masterpiece of individual work, conducted absolutely by himself. The facilities he had of exchanging views with other medical men were very limited, and books of reference were not easy to obtain. Burnley was somewhat isolated in those days by a bad railway service, and motor-cars were in a very early stage of development. . . . It was Mackenzie's custom, in any case which presented special features, to get the patient to come up on Sunday afternoon for further detailed examination. On these afternoons was established a kind of heart clinic, and nothing delighted the doctor more than to get his friends, who were interested in this work, to come and see these cases with him and discuss the symptoms they presented, or wring from them some explanation of the tracings he would show them. Among others I remember coming for the week-end were Dr. Osler (the late Sir William Osler), Professor Keith (Sir Arthur Keith), Dr. John Hay, Dr. Ritchie, Professor Cushny, Dr. Arnold Lee, Professor Wenkebach, Dr. Ross of Toronto and Dr. Cohn of New York. The last two stayed some time with him, and he kept them hard at work investigating heart cases. My part

was, more particularly, to relieve him of the drudgery of the routine work of the practice, and I received the greatest encouragement and consideration at his hands. His fame was now rapidly spreading, not only beyond the Burnley area, but outside the county itself. He was kept extremely busy with consultations which sometimes entailed long railway journeys."

It is pleasant to think that while the giants slumbered men destined to fill the most commanding positions in their profession actually journeyed to Burnley, in spite of the bother and difficulty of so doing, in order to learn the new doctrine from the lips of its author. It is pleasant to think of that brilliant company, the names of which I have just quoted, gathered in the consulting-room at Bank Parade, and I have often called up the picture of the eager Mackenzie expounding his views to these zealous seekers after the truth. It was my great privilege and honour to make the acquaintance of the late Sir William Osler some years before the end of his life. I was struck, as all men were struck, with the bigness and the generosity of his nature, the goodness and the sweetness of the man. I realized then why Mackenzie always spoke his name with delight and affection.

"Osler," he told me once, "came to see me when no other among the big physicians would have dreamed of coming."

He did not add, as he might have done, that Osler belonged to the New World, to Canada and

America, more, perhaps, than to England. Nor did he point out that recognition of *The Study of the Pulse* came from Germany and America and other foreign countries, long before the giants had opened their sleepy eyes to glance at it. As I have said before, there was no vindictiveness in Mackenzie's character.

But the sleep of the giants was destined to be broken. The fame of the Man of Burnley came knocking unceremoniously at their bedroom doors. At a meeting, for example, which was held on the South Coast, four medical men from Germany presented themselves. They had come, they said, to meet and talk with Dr. Mackenzie, of Burnley.

At first nobody paid any attention to them, but their Teutonic insistence at last won its reward. They were informed categorically that there was *no such person.*

"But we have read and studied his book!"

"In that case," said the giants, "it is probable that he exists; but we can assure you that it is not worth your while concerning yourselves about him. We have not heard of him. He is not one of us."

It appears that this reply greatly annoyed the visitors, for it is on record that they answered it thus:

"We have come here to meet Dr. Mackenzie, and not to meet you. We do not care about you nor your big men, who are all very small men outside your own country."

I give this statement as I have received it.

The authority is good. Certain it is that the four foreign visitors at once left the conference and betook themselves to Burnley.

That knock was followed by another. In 1906, Dr. Arthur F. Hurst, then Radcliffe Travelling Fellow of Guy's Medical School, wrote for *Guy's Hospital Gazette* an account of his first year in Germany. He said:

"Of all English physicians, the best-known and most frequently quoted in Germany is, probably, Dr. Mackenzie of Burnley, a prophet who has hardly met, in his own country, with the recognition he deserves. The methods of studying disorders of the circulation introduced by him are much employed, and many important investigations confirming and extending his results have been published in Germany."

It was evident that Mackenzie could no longer be ignored completely, and this the more so that he had been invited to make visits to Canada, America and the Continent, and had accepted those invitations. Mackenzie went abroad; he crossed the Atlantic; he was hailed wherever he went as a seer and a genius. He returned home. Foreign physicians from America, from Canada, from Germany, from France, from Holland, from Scandinavia, came to Burnley to see his methods and discuss his problems.

But the giants did not come. They had heard of him, but was he not a general practitioner? In England, alone of all countries in the world, a man who has practised medicine among the common folk is regarded as having demeaned and

lowered himself by so doing. The giants have no dealings with the general practitioners who presume to encroach on their fields of enterprise. Mackenzie wrote in his book on the *Future of Medicine :*

" There has arisen a tradition that only a select body of men are competent to fill a teaching post. This is the result of human frailty. If, in any sphere of life, a few individuals are set apart and given power over their fellows, it is but human that such a select body will seek to aggrandise their position at the expense of their fellows. It is unnecessary to enlarge on this general statement, as the world's history shows its truth in all spheres of human thought and action. In some spheres it may be good, or it may be bad, but in intellectual matters, and especially in science, it can only be bad. In medicine, the teachers have practically taken into their own hands the guidance of education and all the intellectual interests of the profession, and ordain the course a man must follow who wants to become a doctor.

" We have in London a body—the College of Physicians—which has acquired the power, indirectly, of preventing anyone who is not a member of their body obtaining an appointment as a physician on the staff of a teaching hospital. A young aspirant to such a post must follow certain lines which custom prescribes. He can exclude himself from having any personal contact with patients by spending his time in a laboratory undertaking what is called ' research,' and this is the surest way of attaining his object. He may spend his time in any other form of academic life, but one method he must not pursue—he must

not attempt to qualify himself efficiently for such a post by the experience of general practice. If, for instance, he wishes to see the kind of life his future students would lead, or if he wishes to investigate the early signs of disease, and for that purpose undertakes general practice, he will, by such a step, render himself unfit for membership of the College of Physicians, and so cut himself off from any chance of obtaining a position as a physician to a teaching hospital.

"The College of Physicians practically requires of its members that, while they may pursue almost any one of the branches into which medicine is split up, they must not practise medicine in the only way by which a wide outlook may be obtained, and so render themselves fit and capable to become really effective teachers. . . .

"One special function of a consultant is to foretell what is going to happen to a patient if treated, or if left untreated. To obtain this knowledge it is necessary to see patients through the various stages of disease, and this can only be done by the individual who has the opportunity. The College of Physicians thus prevents consultants following the only way in which this knowledge can be obtained. I have known laboratory-trained young consultants actually refuse to see patients regularly lest they should be considered general practitioners. When I have pointed out to them that they can never assess the value of symptoms unless they watch individual cases of disease for long periods, I have found them incapable of recognizing the need for such knowledge!"

I hasten to add to this quotation the fact that the College of Physicians accepted Mackenzie into its Membership and Fellowship, and that he was

proud of both these honours. He wrote the words I have quoted long after his adoption. He wrote them in no hostile spirit, but only as a part of the campaign he was carrying out to open the eyes of his professional brethren to the need of including general practitioners among the research-workers of his profession. Mackenzie could not be blind to the fact that had not the whole world acclaimed him, he would never have been honoured in his own land with the "rank of a Consultant." He knew that he had been "made a giant" because no other course was possible without stultification. And that was one of the reasons why, in his old age, he broke away from the ranks of the giants to enter on the most dramatic episode of his whole life.

CHAPTER XXVI

"A KNIGHT'S EMPRISE"

THE giants would not come to Mackenzie. He resolved to go to the giants.

He was now fifty-four years of age, a time when few men think of abandoning a safe and most honoured position in order to go crusading. The idea that he could fling himself into the complicated and difficult medical world of London and impose his views on a reluctant profession seemed, to say the least of it, an optimistic one. His friends, and especially those friends who understood most clearly the nature of the "world" he designed to conquer, lost no time in trying to dissuade him. Their fears were written on their faces.

Mackenzie set these fears aside. He knew that unless he went to London his work would not be made manifest. Already he could see that his least important discoveries were being magnified, and his great principles—that "true scent" which it had taken him twenty years of constant work to apprehend—were being ignored. He must go himself, as an apostle of his principles, and, from the vantage ground of Harley Street,

disclose them to the world. There was no other way.

I confess that, when I contemplate that great decision, I am thrilled with wonder. What courage the man possessed! and what supreme confidence in the power of the truth to prevail! He was far from being well off. He had saved very little money. He had no private fortune on which to fall back. And his teaching was likely to make enemies rather than friends. How, in the great maelstrom of London, was he likely to fare without any title to fame other than the merit of his researches? Where were his patients to come from? Where were the doctors who would prefer him as a consultant to the knights and baronets whose names were familiar to the whole people?

He may have asked himself these questions. I do not know. They weighed very little with him, for he had seen his duty. He began to make his preparations for the great adventure.

No Crusader ever set forth with a higher sense of the necessity of what he was undertaking. No Crusader possessed a more exalted sense of the importance of his mission. Mackenzie went forth, truly, in the name of humanity, and for the good of his profession.

Nor was he ready to avail himself of any means of assistance which might, even slightly, damage the great cause he served. He actually refused to sell his invention, the Ink Polygraph. It was manufactured in Burnley, and was marketed at the bare cost price by his express desire.

"Many doctors," he declared, "can ill afford to buy instruments at all. It would not be right to restrict the use of this instrument by enhancing its price; nor could I endure the idea of exploiting the scientific keenness of my fellow-practitioners for my personal profit."

Behold the doctor, then, setting out from Bank Parade, from the house of twenty-six years, from the people whom he had served so faithfully and loved so well, to challenge the leaders of his profession in the greatest lists which the world affords. Quixotic, perhaps! Hazardous, without doubt. But surely an enterprise, nevertheless, worthy of knighthood.

CHAPTER XXVII

JEAN

THERE had been moments of exaltation in these last years in Burnley: the moment, for example, when the doctor knew that this teaching had found disciples in foreign lands; the moment when he received Osler, laden with his international honours, into his house; the moment when, in 1906, he opened the session of the Medical School at Leeds University with an address on the position of the general practitioner as a research-worker, and was acclaimed by a distinguished gathering, which included Sir Berkeley Moynihan, as one of the pioneers of medical research.

But Leeds is not London. These provincial towns are warmed by a local patriotism, to which the capital is a stranger. London would have fêted Mackenzie, had he come as a visitor from the North to deliver a lecture or make a speech. He came as a man who intended to stay, and London remained aloof and cold.

He had taken a house in Bentinck Street, at a high rent—a step which proclaimed how lacking he was in "London wisdom," how imbued with the spirit of Bank Parade, Burnley. The family established itself there after the kindly and

simple fashion which had always characterized it. The man who had never known what it was to lack patients, to be free from incessant calls on his time and his skill, the man fresh from his triumphs in America and Germany, found himself, for the first time in his life, idle, unsought after, almost forgotten.

There were no patients now whose maladies he must watch, no dangers which he must foresee and guard against. There were only acres and acres of streets, the din of a ceaseless traffic, the weariness of pavements, the loneliness which is London's familiar spirit. Set that emptiness against the glow of achievement which this man must have felt as he spoke to eager listeners in the famous clinics of America and Germany, and found himself recognized by these listeners as a great figure in their professions. Compare it with the high hopes of the last of the Burnley days, when the knight was dressing himself in his armour for the great encounter. Here, indeed, were the lists which he had determined to enter; but his challenge rang faint in this immensity. The giants, it seemed, had not perceived him.

The Bentinck Street house was very big and very expensive to run. There was nothing—literally nothing—coming in. The prospect that anything would ever come in did not seem to be very rosy because, although doctors and friends had promised help, this might not materialize. Mackenzie lacked everything which is supposed to be necessary to the equipment of a giant. He was not a member of the Royal College of Physicians

of London, nor did it seem probable that he ever would be a member. That meant that his chance of obtaining an appointment at any London hospital was as apparently remote as his chance of obtaining an appointment on the moon. Thus, he would never be able to teach students, or to exert much influence over general practitioners. Where, then, were the patients to come from ?

"We were," Lady Mackenzie has written to me, "really and truly, *poor* people."

Mackenzie seems to have viewed his poverty and his prospects with a serenity which few men could have achieved. He was engaged on writing his great book on the heart, and also a smaller book on "*Symptoms*," and he devoted himself to these tasks with all the energy at his command. His cheerfulness was never for a moment diminished, nor his faith overclouded. He had come to fight for his ideas, and he meant to fight for them with every weapon at his disposal. One of the things which amused him most at this period was the large number of former acquaintances who invited themselves to visit him and made prolonged stays in his house. These visits, which he would have welcomed at a later period, made serious inroads on the depleted family exchequer.

But he never complained, nor ever refused anyone his hospitality. When he had grown tired of writing, he and his daughter Jean, then a merry girl of fifteen, went for rambles in out-of-the-way parts of London about which they had read or which they found attractive. Jean knew his

moods, and responded to them all, and the friendship between them became very close. The lure of the great city, its mystery, its immemorial magic, its grand and sincere simpleness, appealed to both these romantic and simple souls. They learned to understand London. They tasted, together, that sweetness of her spirit which all whom she has accepted, count among their fairest experience. I like to picture them on these wayfarings: the rugged man, well advanced in middle-age, grizzled, full of his labour and his service; the slim girl at his side, with the spirit of youth in her gay eyes, truants together, for an hour, from the schoolhouse of life. And I suppose that these "outings" must have recalled to Mackenzie's mind the adventurings in the woods at Scone, what time the knights and their ladies rode by on the four winds of history.

Poor Jean! Poor little gay girl! She had then but a few months left her of the glory and sweetness of her life.

I never saw her, and I never heard her father speak her name except on one single occasion when he told me abruptly that his daughter had died of meningitis. Lady Mackenzie has told me, however, that her death in 1909 was the most awful blow which ever fell on a brave heart.

"He was always thankful," she told me, "to be able to recall these 'rambles' with her, and to think they had been so much together. She died . . . and all the light of life went out for us

all in the Bentinck Street home. My husband could never endure to recall those last terribly sad days, and for a very long time his life was overshadowed."

Jean, according to her mother and sister, was very like her father. Her mother told me that she could never concentrate on her work till they came to London, but that shortly after she went to Queen's College, she suddenly flared out, and became a veritable student and shone as a worker. When she died, they had a most touching letter about her from the Head Mistress. She added, "I think they all loved the gay young creature at that College."

Her sister Dorothy has given me this little description:

"Jean used to write reams of poetry, which she would dash off, sitting in front of the fire. She loved writing stories, and illustrating them, and she composed a dreadful piece of music, and she was a perfect mimic. She said to me once, looking into a mirror, 'I'm not a bit pretty, but I have a *funny* face.' She used to leave Bentinck Street for Queen's College five minutes earlier than necessary every morning, to spend time talking to a mongrel dog that was always tied to the railings of a public-house on the way to school. Children and animals loved her, and she was such a generous-hearted, gay child. When she was so dreadfully ill, there was never a word of complaint. I think all the doctors loved her, she was so brave and heroic, and such a young, grateful child. She was sixteen when she died. The doctors told my aunt that they had never seen

anyone like my mother at that time. My father, afterwards, was more understanding, and more patient and more gentle than ever."

I have invited the reader to this intimacy, because it reveals the character of the man whom I am trying to describe.

CHAPTER XXVIII

"MY BOOK"

His daughter's death hurt Mackenzie, so that his spirit was smitten, but the proud Highlander would not show his hurt to the world. With singular faithfulness, he continued his labours on his books.

One of these, the greatest of them all, had been published in 1908, before the blow fell on him. It had, in 1909, begun to exercise that influence which stands with scarcely a parallel in medical history. It was selling, this bulky volume, entitled *Diseases of the Heart*, like the proverbial hot cakes, so that a second edition was required the following year. It was also accomplishing for its author the miracle of miracles. It was bringing him patients.

Mackenzie told me himself that in his first year in London he earned £114. In his second year he earned more than £1,000. When I asked him to what circumstance he ascribed this remarkable "jump," he replied—

"To my book."

He added, however, that he owed a great deal to the kindness of certain professional colleagues, who exerted themselves on his behalf. One of

these was Sir James Purves Stewart, who called one day at Bentinck Street, and urged Mackenzie to accept an appointment as Physician to the West London Hospital. This truly amazing request filled the Burnley doctor with delight, and cheered him greatly. He afterwards became physician to this excellent hospital. A second request came from Dr. Frederick Price to join the staff of the Mount Vernon Hospital, Hampstead, then devoted to the care of cases of consumption. This request Mackenzie accepted. At Mount Vernon he completed his study of the Dangerous Type of Irregularity of the Pulse, Auricular Paralysis, and worked out fully, along with Professor Cushny, the influence of the drug digitalis on this trouble. It was a necessary continuation of the work begun at Burnley. Dr. Price, in addition, advised Mackenzie to move into Harley Street, and offered him a consulting-room in the house where he lived. This wise advice was taken. Mackenzie gave up his Bentinck Street house, and moved out to Northwood, in Middlesex. He rented a consulting-room—soon to become the most famous in London—at 133, Harley Street—paying for it the modest sum of £100 per annum. It was the back room on the ground floor, and was by no means very large.

The great book fell among the giants like a live bomb. It was more than disturbing; it was devastating, overwhelming. Here was not merely a good account of the various diseases of the heart, but an exposition of diseases of that organ, unknown to medical science. And not that only.

Each disease was illustrated by dozens of tracings; each had been analysed and examined with the most amazing care. About each there was presented the ripe and rich fruits of the method of "wait and see." Further, the method of the "true scent" and the researches on breathlessness and pain were fully described.

But these merits, great and signal as they were, were not the book's chief title to fame. Its chief title was its immediate practical utility. It afforded information which might be applied intelligently by any practitioner, and which must enable him to foresee or to discount danger. It was, thus, a new and most powerful weapon placed in the hands of the common soldier of the profession.

And therein lay its power to disturb the rest of the giants. Even the drowsiest of these great men realized clearly that this challenge could not be ignored.

BOOK III

"THE GIANT"

" And Thou,
Self-school'd, self-scanned, self-honour'd, self-secure,
Didst tread on earth unguessed at.—Better so!"

CHAPTER XXIX

SOLES AND HEELS

Mackenzie had come to London to fight for his ideas. He had expected to fight for them, been sternly prepared to fight for them. He had expected, too, to suffer in that battle.

As I have said, these expectations were fulfilled during the first fourteen or fifteen months of his stay in Bentinck Street. But when this time had ended, all his anxieties were miraculously falsified.

I do not suppose that Cinderella herself tasted a greater astonishment than came to the Burnley doctor. In a single night, as it seemed, every difficulty which stood in his way was swept aside. Those whom he had supposed he must contend with, offered friendship instead of battle. His opinions were hailed as the authentic revelation of truth. Every door flew open to welcome his approach.

If I were writing this account as the advocate of the leaders of the medical profession in London, I should say that they showed an extraordinary generosity. For a man whom they scarcely knew, they waived the most rigid rules of their caste. There was no obstacle which they were

not ready to break down on his behalf. There was no honour in their gift which they did not heap upon him with lavish hands. Within an incredibly short space of time, the Man of Burnley found himself invited to become the sole head of a specially created heart department at the London Hospital, to become a great teacher in a great institution. He found the entire resources of this hospital, one of the most justly famous in the world, placed unreservedly at his disposal. He found himself elected, eagerly, a member of the Royal College of Physicians of London, after an examination in which every possible facility was afforded him of displaying to the full his matchless knowledge. He learned that the Royal Society—the most illustrious scientific body of the British Empire, or, indeed, of the world—was about to bestow on him its coveted fellowship. So many honours, of so pure a lustre, had surely never before fallen in so short a time to the lot of any physician. That a general practitioner, but yesterday arrived from the provinces, should obtain them was amazing, incredible, unheard of.

Here, surely, was signal proof that Mackenzie had misjudged the character of the opposition to his views which he had already encountered from the London faculty! Mackenzie himself undoubtedly thought so. The kindness shown to him, the appreciation, overwhelmed him and filled him with gratitude. Humbly, according to his nature, he accepted the splendid and wholly unlooked-for offer which Lord Knutsford, the distinguished Chairman of the London Hospital,

conveyed to him. He accepted the recognition of the Royal College, the Fellowship of the Royal Society, the Knighthood which soon followed these professional honours. His heart glowed with kindly feelings and with the determination to requite all this goodness by every means in his power. A great joy possessed him. His teaching was now bound to reach the whole world. The principles for which he had laboured so long and so earnestly had already, it seemed, captured the minds of his brethren.

I possess a letter which Mackenzie wrote me at a later period of his life. It refers to a discovery he had just made, and to the reception accorded to this discovery. It runs:

"In the first flush of gratification, I thought our discovery would startle the world. I have been discussing it with a number of capable men, and they fail to grasp its significance; so I find I'll have to work at it a good deal until I get sufficient data to carry conviction."

Mackenzie always overestimated the eagerness of human beings to obtain enlightenment, judging them, in this respect, by himself. He accepted gratefully and gladly the honours they offered him, because he thought that these honours were accorded to his principles. *In fact, they were accorded to his polygraph.*

There, in his polygraph, and the tracings he made with it, lies the real explanation of his sudden leap to fame—and that not only in England, but in America and in Germany also. His polygraph

was what it is the fashion to call an instrument of precision. The records he made with it were "scientific data," things which other men, similarly equipped, could make and examine. The giants realized this the moment they began to look into his work. These tracings could not be ignored; they were facts. Moreover, they were new facts. It was absolutely certain that every student of the heart and its diseases would take account of them.

This had, indeed, happened already in Germany and in America, where the tracings had been under discussion for a considerable time. Mackenzie's interpretations of the various waves had been tested by many of the most renowned investigators, and had been found to be accurate. There could be no manner of doubt that, to quote a certain cynical physician, "this lucky fellow had gone for a stroll, and stumbled into a gold-mine."

The Man of the Tracings, therefore, was a force to be reckoned with. He was "scientific." He was possessed of the key to great and most promising discoveries. It was felt, and felt honestly, that he deserved the very best which his profession could offer him. It was felt, also—and in saying that, I am not attempting to be cynical—that were honours not accorded to him, dishonour must befall the leaders of medical thought. Unofficial genius is the greatest of all the dangers which threaten official reputation.

The giants, in short, took their hats off to the tracings. Mackenzie thought that their homage was being rendered to his great principle that the

efficiency of the heart can be measured only by its response to effort.

And thus a strange and most comic situation was brought about—a situation in which both parties believed firmly that they had conquered each other. The giants told themselves that a good thing had actually come out of Nazareth, that a general practitioner had actually "raised himself to the status of a consultant" by the adoption of scientific methods. Mackenzie, on the other hand, believed that his apostolic zeal had converted the minds of the giants, and brought them to a saving knowledge of the truth that the fundamental principles of medicine can be learned only in general practice. He supposed that, having accepted his principles, they would proceed, in a humble spirit, to amend their own ignorance.

His earliest addresses and lectures given in London show very plainly how convinced he was that the battle he had come to fight had been won at the very first round. He spoke freely and confidently of the "new criterion" of the heart's efficiency, as though all his hearers had accepted this criterion. He dilated with zest on the power to foresee danger, which the power to estimate the heart's efficiency had placed in the hands of doctors. He talked about "a touchstone of the significance of murmurs and irregularities," as if the consulting physicians who listened to him had realized the deceptive character of these signs when regarded by themselves. And he made light of his tracings and his polygraph, in the

honest belief that everyone understood, just as clearly as he understood, the limitations of these "mechanical aids."

In one of these lectures he pointed out that there are four stages in disease, "the predisposing stage, the early stage, the advanced stage, and the final stage," and remarked that the history of medicine showed that disease could best be studied by starting at the end and working backwards. "It can be said," he declared facetiously, "that ample provision has been made for the study of disease after it has killed its victim." Provision had been made also, on a generous scale, for the study of the advanced stage, but the predisposing stage and the early stage had not been studied, and hence the power to foresee danger was lacking. Mackenzie continued:

"If the conditions which predispose to, or provoke disease, are to be recognized, the investigator must have the opportunity for seeing the circumstances which led up to the invasion of the disease. It is manifest that neither the laboratory-worker nor the hospital physician, who are the persons mainly concerned with research, have this opportunity. The early stages of diseases are, as a rule, insidious, and are indicated mainly by subjective sensations. The patient, becoming conscious that there is something amiss with him, does not, as a rule, seek help from the hospital physician, but from his family doctor. The bulk of patients in the early stage of disease are never seen by those who are systematically engaged in its investigation."

This was a "call to repentance" with a vengeance. The Man of the Tracings was actually suggesting that giants were of small use to the future of Medicine; that their knowledge concerned only the late and hopeless stages of illness; and that, if they would achieve any worthy service, they must become as general practitioners—"family doctors," or else attend the out-patient departments of the hospitals where early disease may usually be studied!

"Had I," he said, in effect, "been a giant and not a general practitioner, I could not have learned how to foresee danger in cases of heart disease. I might, indeed, have invented my polygraph, but even so I should have fallen into the error of supposing that that instrument and the tracings I took with it represented a real advance in knowledge. I should not have known, as I now know, that my study of irregularities of the heart was mere 'muck-raking,' until I learned how to test these irregularities by reference to the fundamental principle that the measure of the heart's efficiency is its power of response to effort, and that irregularities which do not impair this power are not in themselves of a serious character."

The giants gasped as they listened. A bench of bishops being called to repentance by a freshly ordained curate could not have experienced a more lively amazement or a sharper indignation. Was this the man whom they had taken to their bosoms? Was it actually possible that the Man of the Tracings was unaware of the signal honour which had been conferred on him? Did he not

realize that it was his tracings which had won for him his elevation to the peerage of his profession? Mackenzie answered them out of the fullness of his heart.

"What," he asked, "are the methods adopted to instruct students in the early signs of disease? In the hospitals, where all instruction in clinical medicine is given, the patients in the early stages go to the out-patient departments. Common sense would say, therefore, where the signs of disease are the most difficult to make out, and the hope of cure is at its highest, the most experienced physicians would be employed, and that all the aids of laboratory technique would be at hand to help in the recognition of the disease. In no teaching institution is this ever done. Here, instead, is placed the youngest member of the staff, lacking in experience, ignorant of the meaning of the signs, and incapable of eliciting them. He searches carefully for physical signs, and if there are no physical signs, the patient is either discharged with a bottle of physic, or told to return from time to time until a physical sign is discovered; then, and not till then, is he sent to be under the care of the skilled physician; and then, and not till then, does he receive the assistance of laboratory methods in his examination.

"On the other hand, in the wards, where disease has advanced so far as to produce physical or other demonstrable signs, mostly easy of recognition, we have the trained physician, the research student, and all the paraphernalia of laboratory assistance."

The giants doubted no longer. They understood, at last, that Mackenzie was attacking

themselves. A wave of resentment swept their hearts, expelling those genial feelings with which, a short time before, they had welcomed him. To his great astonishment, the Burnley doctor began to realize that his supposed converts had never, in fact, been converted at all.

His first feeling, when this truth began to dawn on his mind, was one of indignation not less acute than that of the giants. When the indignation had passed, there followed a sense almost of despair. To think that his title to distinction in the eyes of his brethren should be the very kind of work of which he had spent his life proving the fallaciousness ! To think that it was as the Man of the Polygraph, the Man of the Tracings, and not as the Man who had learned to Foresee Danger that he had been honoured ! To think that the husks had been valued, while the fruit was ignored !

Mackenzie, however, was no man to give way to despair. His keen and ever-present sense of humour came to his rescue. He saw the comic side of it all, even while he regretted the pity of it. Once again the mechanical device, Science, with a capital S, had triumphed over both mind and reason.

" In some respects," he wrote, with a flash of ironical mirth, " the ideas which led to the employment and adulation of these mechanical devices may be compared to those ideas which sometimes prompt the imitators of a traveller just returned from an unknown country. The traveller, let us suppose, has come back and told all that he has

seen, and has, incidentally, mentioned that a certain type of boot has helped him in his journeyings. His imitators, without in the least knowing what he is talking about or understanding the significance of the new knowledge gleaned by him, begin to make improvements on the boot. *They hail him as the discoverer of a new form of footwear!*"

Mackenzie had come to London as a man with a message; he had been loaded with honours, which the bigness of that message seemed to deserve. He found himself, suddenly, a mere shoemaker, singled out from his fellows because of the excellence of his soles and heels.

He witnessed, too, the amazing spectacle of the whole company of the giants bending zealously over their lasts, diligent disciples, as they supposed, of a new teacher. In America, in England, on the Continent, soles and heels had become the hall-mark of what was already spoken of as "The New Medicine."

CHAPTER XXX

IN HARLEY STREET

Mackenzie's displeasure against the giants was short-lived. This man harboured no animosities. Moreover, he came to understand that a giant can never be anything other than a giant. The good citizens of Harley Street and Wimpole Street thought as they did, and spoke as they did, and understood as they did, for the simple reason that they had never had any experience of general practice. Not one of them had stood, as he had stood, by the death-bed of a young wife, newly dead with her unborn babe in her womb, and realized, with awful searching-of-heart, that the power to foresee the danger which had overwhelmed her was not in his possession. Not one of them had felt the need of the power to foresee, as every family doctor experiences it on every day of his working life. Mackenzie said to me once:

"I have no quarrel with Harley Street, except that it is Harley Street. It is concerned so much with those who are stricken to death, so little with those who have just begun to be ill, that, as a rule, there is nothing to foresee. Thus the vital and tremendous importance of the power to foresee is overlooked."

He wrote, in his short book on *Principles of Diagnosis and Treatment in Heart Affections*:

"Not long ago an eminent physician stated that my investigations into the meaning of irregular action of the heart revealed nothing new. He and his colleagues understood perfectly well all the essential matters concerned with irregular action. Within a few weeks, as it happened, my opinion was asked regarding the irregular heart of a girl whom this physician had ordered to stay away from school for three months. The order had been given wholly on account of the irregular action. Yet, in my view, this condition, far from being a sign of heart trouble, was, in the girl's case, a sign that the heart was free from trouble."

Mackenzie's "view" had been acquired by twenty years of bitter experience, by the long and tedious method of "waiting and seeing," by his analysis of the symptoms presented by innumerable patients, and by his discovery of the great central guiding principle that the test of a heart's strength is its power to work, its response to calls for effort. How could he hope that a physician, who had never been "through the mill," who had never, day by day, followed the lives of his patients in practice, would be able to grasp his meaning?

In other words, it was sheer waste of time and energy to attempt to call the giants to repentance. They could not repent, because they suffered no sense of their own shortcomings. Hope lay not in the present, but in the future; not with the giants

concerned solely with "soles and heels," but with the students and the young physicians whose minds had not yet become closed to new ideas. Mackenzie flung himself with all his zeal and energy into the task of teaching his ideas to his students at the London Hospital, and to that band of disciples which soon gathered round him.

He was now one of the busiest men in London, or, for that matter, in the world. His waiting-room was overflowing with patients, men and women and children of all classes and types. He had become the fashion, almost the rage: "Cupid," a wag remarked, "never broke hearts so fast as Mackenzie mended them." His new patients received neither more nor less consideration than had his beloved "folk" in Burnley. He was no respecter of persons—for which reason some foolish ones were offended. His great principle enabled him to work quickly, and, often enough, three minutes sufficed. Had the patient a good power of responding to effort? Even his polygraph was but seldom called into action, though it always stood at his elbow ready to be used. He never once, in his whole life, "played" a patient with those cunning tricks and devices in which mean men so greatly delight. Again and again, as I watched him I thought of that Lord of the Syrians who visited the prophet Elisha to be cured of his leprosy, and of his anger when the prophet told him curtly to go and dip in the River Jordan. There were a few patients who thought and spoke like Naaman:

"Behold, I thought, he will surely come out to

me, and stand, and call on the name of the Lord his God, and strike his hand over the place. . . ."

The simple old man, with his kind eyes and quiet manner, filled the foolish with misgivings. Where were the "electric pictures" of the heart? Where were the X-rays? Where were the vaccines? And where the mystic incantations of those doctors who are so popular with a certain type of patient?

There were other patients, however, who knew better. I heard the late Lord Northcliffe, no mean judge of men, declare of Mackenzie, whom he had consulted on one occasion:

"A great man—a very great man."

Northcliffe contributed five hundred pounds for five years to the Clinical Institute at St. Andrews which Mackenzie ultimately founded.

That simple consulting-room, with its roll-top desk and unpretentious furnishings, and its equipment of an old wooden stethoscope, an ink-polygraph, and one of the earlier models of the Riva-Rocchi blood-pressure instrument (an instrument he seldom used owing to his disbelief in the whole "blood-pressure business") used to thrill medical men of the right type to their core. *They knew.*

"A great deal of our recent knowledge of heart conditions," he wrote, in the preface to one of his books, "has been attained by the use of such mechanical aids as the polygraph and the electrocardiograph. These instruments are not available to the general practitioner, so that, if the recognition of diseased conditions were to depend on

their use, much of our recently acquired knowledge would be of little practical value. It has been a constant endeavour on my part to recognize the different conditions which these instruments have revealed, by employing the ordinary bedside methods of examination. . . ."

Throughout all the years of his Harley Street practice, Mackenzie found himself "up against" the "soles and heels" type of medical practice, and his writings and conversation abounded in examples of the trouble this kind of thing caused him.

"A friend of mine," he recounted, "whose wife was being treated at Nauheim, was once much upset at that place by being told that his heart was affected when he had casually suggested that he should have one of the baths himself, and had submitted to examination as a preliminary. The doctor felt his pulse, assumed an air of great gravity, declared that the heart was 'bad,' and insisted on his taking a 'cure.' When my friend returned home, I had some little difficulty in restoring his confidence in himself, for the treatment had had no effect on the irregularity, and he kept feeling his pulse for the intermission" (extra-systole). "That is nearly twenty years ago, and he is quite well to-day, although the pulse still shows these intermissions at times. Fear of this kind will cause strong, healthy men to put themselves to any amount of trouble in order to 'get cured.'"

The Nauheim treatment, which he had studied carefully, always struck Mackenzie as being of

small value, and he used, jocularly, to advise people to "get into a hot bath at home, with a few bottles of soda-water," instead of going abroad to obtain it.

Of another case he wrote:

"A man consulted me some years ago, because of an intermittent heart. When he sat down, I noticed that his right hand instinctively sought his left wrist, and that a finger was kept on his pulse. I knew at once what I had to deal with. His story was this: His doctor, in one of the Western States of America, had found his heart irregular, and, being unable to cure him, had sent him to a celebrated physician, who had treated him for some weeks, with no improvement. He next went to New York, and was again treated by a distinguished physician, without result; then he was recommended to go to Nauheim. On his way through London he consulted me, and, on inquiry, I found that his whole trouble was due to the consciousness of these extra-systoles. I asked him when he could get a ship back to America, and he said, 'In four days.' I told him to take it, get back to his work, and never feel his pulse again. This he did, and I heard from him lately to the effect that he was in good health. When he had too much office work, he was still conscious of the intermissions, but when he took an active holiday in the woods, hunting and shooting, the intermissions disappeared."

Nor were intermissions of the pulse the only signs detected by the industrious "cobblers" which Mackenzie found himself forced to discount.

"Blood-pressure" was another of his bugbears. He wrote:

"It is as a guide to treatment that blood-pressure is supposed to be of especial value. Happily, here we are prevented from doing any harm, for we are practically powerless to affect it. . . . It has been a matter of interest to me for many years to note the attitude of spa physicians towards blood-pressure. Each physician advocates the claims of his particular spa for the reduction of the blood-pressure. A few years ago, the virtue was claimed for many spas that their waters produced a strong and firm pulse; now, when a low blood-pressure is the fashion, these same waters have the contrary virtue, and reduce a strong pulse to a weak one." He added, "In treating this subject in a somewhat disparaging manner, it is not my intention to discourage the use of blood-pressure observations. Far from it. My intention is to insist upon the importance of investigating the matter on the lines that will be productive of useful information. . . . I would suggest that general practitioners should take note of the blood-pressure in a number of their patients, particularly those whom they are able to keep under observation. These observations should be taken in the young, as well as in the elderly. They need not, at first, be taken frequently, but as circumstances permit. From time to time, certain cases will be found which need more careful observation, and these should be persistently followed. In every case attendant circumstances should be noted, particularly the state of the arteries, heart and kidneys. It is only by approaching the problem in this way that the condition can be observed in its proper

perspective, that the circumstances which favour its onset and modify its progress can be recognised, and the factors with influence its bearing on prognosis be accurately defined."

Mackenzie's advice to his patients was always practical and never of the "guarded" type. He told the victims of angina pectoris—that is, patients whose heart failure was revealed by pain in the left side of the chest—to indulge in as much effort as they pleased, so long as they suffered no distress—so long, that is to say, as their hearts showed no sign of being unable to respond to the calls made on them. The same rule guided him in connexion with children. Children, he knew, are very sensitive to distress, and always cease their efforts, if left to themselves, as soon as signs of heart failure or heart exhaustion show themselves. He declared, "Even when the heart is damaged, and its efficiency impaired, no harm will ever result if the amount of effort is left to the child's own judgment."

The rules were based, of course, on the principle that the test of the heart's power is its response to effort. Mackenzie was amazingly bold in his application of them—so much so, that often professional colleagues gasped in spite of themselves.

"Some years ago," he recounts in *The Future of Medicine*, "I was consulted by a man of sixty-eight years of age. He looked fairly well, but had a slightly enlarged heart, with the irregular pulse characteristic of auricular fibrillation" (the Dangerous Type of Irregularity). "When I

asked him what amount of exercise he was able to undertake, he answered that he could not tell, as, a year ago, he had been seen by two distinguished physicians, who forbade him to take exercise, and he had been carried up and down stairs to bed ever since. I requested him to go and walk about till he got short of breath and return to me in a few weeks' time. He did this, and stated he could walk a couple of miles in comfort. I then told him he was to take any kind of effort he liked, provided he slowed down or stopped as soon as he became short of breath. He asked me if he could cycle, as he was very fond of it, and I told him he could cycle, if he followed the same instructions. He reported himself from time to time. He went to Australia and back when seventy years of age; had a severe illness from appendicitis, resulting in operation, at the age of seventy-two, and when last I heard of him, he was seventy-five years of age, and in fair health. During all this time the auricular fibrillation had persisted."

Here is another case from the same book.

"Sixty years ago, I was consulted by a man sixty years of age, for attacks of a pain which he described vaguely as occurring over the upper part of the abdomen and chest. Left to himself, he gave no clear idea of the situation of the pain or what circumstances caused it. On careful inquiry, I elicited certain facts which gave me a clear perception of the nature of his symptoms. By appropriate questions, I obtained a good idea of the manner of onset of the pain, the situation in which it first appeared, and the region into which it spread, how long it lasted, and the circumstances

attending its production. A physical examination revealed no abnormal signs in any organ of the body, beyond those senile changes which we are accustomed to associate with a man of sixty years of age. . . .

"The symptoms were, to my mind, characteristic of the early stage of one form of angina pectoris, and I informed the patient that they indicated slight degenerative changes in the arteries supplying the heart muscle; that in the future he would find himself unable to undertake as much effort as he had been accustomed to, and I gave him directions as to how he should manage his life and his diet.

"He was one of those men vain of their health and strength, and was evidently displeased when I told him that there were signs of advancing years which he could never get rid of, so I told him if he neglected these warnings, the exhaustion of the heart would proceed at a more rapid rate, and the pain be more and more easily provoked, whereas, if he followed my instructions and lived at a lower level, he would have many years of useful life before him.

"I did not see him again for nearly two years, when he again called upon me. He was much worse, the pain at times being very distressing, and provoked now so easily by effort that he could only walk a short distance. I asked him if he had followed my advice, and he replied that he had not.

"When I asked him why he had not done so, he told me he was disappointed when I told him the nature of his trouble, and, on discussing the matter with a friend, this friend told him of a celebrated German physician, who would give him a far more thorough examination than I had given.

"So to Germany he went, and there he was

subjected to a very thorough examination—not only by the physician himself, but by experts who gave him test-meals and bismuth meals, with X-ray examinations of his intestines, of his heart and blood-vessels, and other parts of his body. He was examined with blood-pressure instruments, and the electrocardiograph. His blood and other body fluids were examined chemically and microscopically, and he was subjected to a number of mechanical devices. Altogether, the visit lasted five days, during most of which time he was under examination. The physician finally saw him, and told him that the examination revealed no disease of the heart, which was perfectly sound, but there was some error in metabolism, and it was to this his sufferings were due. For treatment, a special diet was recommended, with the assurance that this would cure him of his complaint.

"The patient was greatly impressed with this examination and expressed unbounded admiration for the scientific methods of the Germans. When I asked him had he benefited by the treatment, he grudgingly admitted that, though he had faithfully followed the instructions, he had not improved, and, in fact, had got worse. It was because my prophesy had come true that he had returned to consult me."

Mackenzie commented:

"The admiration which the patient had for this style of examination is so universally shared, even by members of the profession, as being 'scientific,' that the style threatens to become a method established by those in authority. Yet it is the best instance of pseudo-science that we can find. It would seem that it is not appreciated

that I had used a method specially adapted to clinical medicine, namely, the experience of many years' observation in such cases. If the reader will have grasped the steps I had taken to investigate this type of patient, he will recognize what a long training I had to undergo to enable me to estimate the meaning of the essential symptoms in this case—that is, the nature of the signs evoked by an exhausted heart."

True science, the "science of medicine," as he delighted to call it, must, Mackenzie realized, deal with "essential symptoms" first. The difference between his method and that of the German physician was simply this: Mackenzie had spent twenty years finding out which are the essential symptoms in cases of heart trouble, whereas the German had not even realized the need for this knowledge. The German was careful, and troubled about many things, whereas one thing only was needful. He looked for a hundred signs, but the sign that mattered, the pain on effort which revealed the failure of heart-power; he did not look for, and did not observe it, though it was the most obvious feature of the case.

That case illustrates perfectly Mackenzie's dispute with the giants and their satellites, the men of the laboratories. At this hour, very few of either of these groups of medical men have realized the nature of the charge which he brought against them. They seem to think that he was attacking laboratory methods as such, and exalting what they contemptuously describe as the "put-out-your-tongue" type of practice. They

do not dream that what he was really attacking was failure to think, to reason, and what he was really exalting was the common sense which asks, "Is this heart capable of its work, and, if not, why not?"

I saw an illustration of the same kind of thing once when a research worker explained to Mackenzie that he was not sure whether or not the small blood-vessels of the skin are under nervous control. He had, so he declared, attempted to study the matter by examining the web of a frog's foot under the microscope.

"One can see the blood moving in the small vessels of the web," he explained.

Mackenzie nodded.

"One can also," he observed, "see a girl blushing when the name of her lover is mentioned."

That common-sense answer, I think, displeased the man who heard it. But it seemed, nevertheless, to settle once for all the question whether or not the blood-vessels of the skin are under control of the nerves. Frogs' feet were never, in Mackenzie's mind, a good substitute for the faces and facial expressions of men and women.

On another occasion, at St. Andrews, or so he told me, a test-meal consisting of a cup of tea and a slice of dry toast was given to a healthy young athlete, to find out the normal effect of it in causing a flow of stomach juices. To the horror of the doctor who was conducting the experiment, the juices, when they were obtained by means of a syphon, were found to be lacking in one very important element. What could it mean?

Surely this fine young man was not a victim of disease ?

The case was referred to Mackenzie, who advised that the boy should be given a good hearty meal of beef and potatoes. This was done, and the stomach juice was again drawn off and tested. The juice was now richly supplied with the missing element. Mackenzie commented :

"I quite thought no self-respecting young stomach would produce its juices for a miserable cup of tea and a bit of toast ! "

This great doctor, as I have said, studied life and loved life. All his thoughts were concentrated on the power of life to maintain itself, and hence he was quick to observe any sign which marked a weakening of that power. His sturdy common sense, itself a product of robust living, led him to the " essential symptoms," and so supplied him with a reliable means of measuring the importance of all the other symptoms presented by the case. He did not neglect these other symptoms, and he did not despise nor reject the work of those who might be able, in laboratories or anywhere else, to make these other symptoms manifest. The " mint and the cummin " had their own place ; but the " weightier matters of the law " came first.

Let me set against the German physician's " science," that " science " which to-day is practised with ever-increasing enthusiasm throughout the whole world—Mackenzie's description of a

line of investigation on which he once embarked, but which he had no time to follow up:

"Having a large number of people with digestive troubles under observation, I resolved to see if I could get a clearer idea of the action of remedies on the digestive tract. Most of the patients presented few or no physical signs, so one had to depend upon the description of their sensations, and that required a good deal of discrimination. For instance, flatulence was a common complaint, and one had to get a clear idea of what each patient meant by such an expression as 'wind on the stomach.' A careful inquiry elicited the fact that a considerable proportion of the patients who complained thus were really air-swallowers—a habit of which many were unconscious.

"Eructation and 'heartburn' were common complaints, and benefit usually followed the taking of soda and bismuth. A study of the circumstances under which heartburn appeared, its relation to the time of taking food, and the kind of food, showed that there were different varieties. As many were food-bolters, or ate and drank at the same time, their symptoms could be relieved and permanently cured by getting them to take dry food in small mouthfuls, and performing thorough mastication. I tried to understand the real cause of the complaint, but my lack of knowledge of diseases of the digestive tract was too great to enable me to get far.

"The action of aperients is a subject which forces itself upon every practitioner, and I tried to understand the effects of different kinds. It soon became apparent that constipation was a far more complicated matter than I had suspected.

The fact that people react differently to the various aperients, shows that there must be factors concerned which we do not yet recognize. This is manifestly the case, for constipation occurs associated with diseases at different levels of the intestinal tract. A very instructive line of observation was found in noting the action of aperients, and I think it would be a useful method to adopt in teaching for students to note the effects of simple aperients on the patients who have to take them.

"This has never been done, even by experienced physicians, and it is wonderful what light can be thrown upon the symptomatology of the intestinal tract in this way. For instance, the time that an aperient takes to act is of importance in recognizing the rate of intestinal movements in the different diseases. The sensations evoked in the patient—the feeling of collapse, at times allied to shock, and the phenomena produced in other organs, *e.g.* the heat and blood-vessels, should be observed. The appearance of pain indicates that peristalsis" (bowel activity) "has occurred, and the situation of the pain and cutaneous hyperalgesia" (skin tenderness) "and hardening of the abdominal muscles reveals the portion of bowel which has passed into peristalsis."

It is the pitiful truth that such a study of constipation has never been made, though whole libraries of books on the subject have been published. No one has gone out in search of a guiding principle, and therefore the "essential symptoms" which might lead to a recognition of the true cause of the trouble, have never been

identified. Thus, the victims of this common affliction try hundreds of remedies and visit, as a rule, large numbers of doctors. Sometimes they obtain benefit, sometimes not. Elaborate examinations are carried out by the latest methods of "science"; elaborate and irksome diets are imposed; operations are performed. But nobody knows the answer to the simple question, "Why is it that, of two persons who live much the same lives and eat much the same foods, one is always constipated and the other never suffers from this trouble?" Until that question has been answered, the treatment of the affliction will remain in its present unsatisfactory state. Mackenzie's comment stands:

"Physicians learned in the action of remedies, have never studied the effects of a dose of castor oil on a constipated girl."

And that is only one example of the monumental ignorance which prevails about the action of most drugs and remedies. Let me quote once more:

"I resolved to test the action of heart drugs. . . . Strychnine had a great vogue, its effects being insisted on by physicians and surgeons—the latter, indeed, often refusing to operate on a patient under an anæsthetic unless the patient had a preliminary dose of strychnine, while anæsthetists had often beside them a hypodermic syringe ready charged, lest the heart should fail. To my surprise, I could get no result with strychnine whatever. In medical doses, by the mouth or by hypodermic injection, no effect

could be traced on the healthy heart, nor on people in a state of collapse. I read up the literature, and, beyond assertions as to its value, there was not on record a single instance where there was given any evidence to justify the belief in its properties."

Mackenzie's power of foreseeing danger, or of discounting it, depended entirely on his knowledge of the "essential symptoms" of heart failure (*i.e.* breathlessness and pain), and on his discovery that the true test of the heart's power is its response to effort. These principles are beautifully simple. They are so obvious, *once they have been grasped*, that it is difficult to understand how anyone could have overlooked them. Yet it is a fact that the Burnley doctor speedily earned in Harley Street the reputation of a prophet. He was referred to, even by doctors, as a "wizard"; that is to say, as a man possessed of supernatural sources of power. Mackenzie might resent these terms as much as he pleased, and he did resent them with all his soul; but he could not escape them. That human instinct which rejects the simple for the obscure and mysterious was too strong for him. All kinds of fantastic stories about his "second sight" were told and believed.

"It is not second sight which I possess," he said to me once, "but only *sight*. My eyes were opened because I had real need to use them."

He drummed this truth incessantly into the ears of his students, both qualified and unqualified. He bade them understand the principles on which he had worked, and he warned them, again and

again, and yet again, against the dangers of mistaking a fact or a collection of facts for a principle, and of supposing that any instrument, stethoscope or polygraph or electrocardiograph, can replace the mind and reasoning powers of the doctor himself.

CHAPTER XXXI

YEA OR NAY

THE discovery of Pasteur that disease is frequently due to the activities of germs, was so important that it occasioned a *bouleversement* of medical opinion. Before Pasteur, medicine was concerned with men and women, their humours and their weaknesses. During the half-century which followed the first announcements of his work, medicine became concerned with germs. It is still largely concerned with germs, though there are signs now of a reaction. The giants, when Mackenzie began to practise in London, were not on very good terms with the bacteriologists, the Men of Germs, but they were very frightened of them. The bacteriologists, on the other hand, made no secret of their attitude to the giants. They spoke of them flippantly, as "the Bedside Baronets."

I would have my reader note that phrase, which is illuminating. To the man in the laboratory there is always something "haphazard" about the sick-room, with its complications of psychology and sentiment. The man in the laboratory loves precision. He likes to add two and two together and make four. He likes to perform "tests" which answer him Yea or Nay.

And he dreams of the day when the practice of medicine will be conducted on "Yea or Nay" principles. This is quite natural.

A good example of laboratory medicine is furnished by the disease syphilis. On this disease being suspected, the Man of Germs performs what he calls a "Wassermann." This test says definitely either that syphilis is present, or that it is not present. If it is present, the germ may possibly be found. In any case, a dose of Ehrlich's famous drug "606" can be relied on to cure the patient. The question is asked, "Can any bedside physician equal this performance of science?"

The giants could not, apparently, think of any answer to this, nor to any similar question, and consequently were forced to make speedy terms with the Men of Germs. Medicine entered on what is usually called its "scientific" phase, that is to say, it became a business of germ detection, of tests, of vaccines. The "bedside" element passed under a cloud, and Harley Street adopted, with full enthusiasm, all the inventions of all the laboratories—bacteriology, immunology, radiology, hæmatology, and the rest of them. The giants, in short, capitulated.

They were entirely sincere in this course of action. They believed that these "precise methods" of diagnosis were far better than the "older methods" they had replaced. They believed that the findings of an instrument or a test-tube are much more reliable than the findings of a man. "Healing without the intervention of the patient," seemed a most inspiring aim.

In Mackenzie's eyes, however, this capitulation wore a very different aspect.

"*Bedside* Baronets?" he asked once, in my hearing, when that expression had been used, adding: "Do you suggest that the bedside of his patient is not the proper place for a doctor to carry on his work?"

The researches on syphilis were quoted. Mackenzie replied:

"Is it not a fact that the germs of syphilis will live and flourish in the very drug '606' which is supposed to kill them?"

"It is a fact—yes."

"Does not that suggest something to your mind? Does it not suggest that the cure effected by this drug is a more complicated business than you had at first thought? Does it not suggest that the cure, when it occurs, is brought about by the drug, *plus* some element or quality of the patient's own body which, presumably, the drug calls into play?"

This was granted at once.

"Very well, then," asked Mackenzie, "is it not a matter of the first importance to understand how that element is called into play, and why it is called into play? For you will admit that there are many cases of syphilis, particularly of the nervous system, in which '606' is not successful."

He thought a moment, and then added:

"Every case of syphilis differs from every other case. In some the disease is actively progressive; in others it lies latent. Some respond

to treatment, others do not. When '606' was first introduced, we were told that a single dose would cure. Then we were told there must be many doses. Now it is said that the treatment must be continued over long periods, and must be combined with the old treatment by mercury. In other words, the earliest hopes have not been fulfilled. And why? Perhaps because this excellent drug, or its modern form, is being used indiscriminately in all cases, whereas it is really suitable only for a certain type of case. Surely it is important to find out how and where it acts? Yet that knowledge cannot be obtained until we know why, in one man, syphilis attacks the nervous system, in another the heart and blood-vessels, in another the bones, and so on. Don't you see that each patient is affected differently by this disease, just as each patient is affected differently by all diseases? The success of a treatment must depend on the knowledge we possess of the effect of the disease on the individual. That knowledge can only be obtained at the bedside, after long years of study. To shut your eyes to this truth, is to sacrifice many lives."

He wrote in *The Future of Medicine:*

"It will be asked, no doubt, 'Are we to wait while these observations'" (at the bedside) "' are being carried out, and thus lose the valuable aid which the discoverers of a new laboratory method claim for it?' If anyone will read the true story of every mechanical device, he will discover that the predictions made at first as to its value have never been fulfilled. I have already referred to the harm which the neglect of this advice did to medical science in the case of the stethoscope, and

which is being done to-day in the use of blood-pressure instruments, the X-rays, and the electro-cardiograph. Everyone knows what harm has been done by the misinterpretation of the shadows in the lung and other organs revealed by the X-rays, and by the conclusions drawn from a reaction to tuberculin. The whole history of the tubercle bacillus is but an exemplification of the neglect of this precaution. The mischief which the random use of mechanical methods has done is incalculable."

In capitulating to the bacteriologists, the physicians abandoned one of the strongest positions which men ever occupied: the position that life can be studied only in the living. Disease is an interference with life, and its "symptoms" are clues to the manner of that interference. The object of treatment is to remove the interference. Bacteriology and all the other sciences which are ancillary to medicine, are of use in medicine only in so far as they assist the doctor to find out why and how life has been interfered with, and how the interference can be removed. An example will make this clear.

A man is stricken with a vague illness, which causes him to sweat and lose weight. He presents the signs of a low fever. It is found that tubercle bacilli are present in his spit. An X-ray examination reveals the presence of a shadow in his lungs. He is said to have tuberculosis of the lungs—"consumption." It is assumed that the diagnosis is complete, *i.e.* that the cause of the trouble has been found out. In fact, however, the cause of

the trouble has not been found out at all. This is evident when it is recalled that post-mortem examinations carried out at a great London hospital suggested that upwards of eighty per cent. of all the citizens of the metropolis suffer at one period or another from "consumption," but recover from it—(healed tubercular lesions were found in the lungs). Why should some people be able to throw off the germs of this disease, while other people are not?

There is the real question. For did we but know the answer to it, we might, by suitable means, enable our patient to get rid of the interference with his life, which the disease is causing. How can it be answered? Manifestly, only by discovering the circumstances which prevented natural healing. Bacteriology cannot help us here, nor can the X-rays. Only the bedside doctor can obtain the necessary information; and even he can obtain it only by the use of the method of "wait and see," by following large numbers of people over many years and marking those whose "cough" or "cold" developed into consumption. That "waiting and seeing" would reveal, without doubt, special circumstances preventing natural healing; in fact, the truth that certain dusty occupations predispose to tuberculosis was discovered in general practice. But even this would not be enough. It would be necessary, also, to find out how the special circumstances affected the patient—their influence, for example, on his breathing, their tendency to irritate and so cause coughing, their effect on the

blood-vessels of the lungs. This would mean the use of the method of discovering the mechanism of symptoms, and would entail a prolonged bedside research similar to that carried out by Mackenzie in connexion with irregularities of the heart. Finally, it would be necessary to ask, "How can I foresee danger—the danger that natural healing will not take place—in this case?" In other words, which of the signs or symptoms present are *essential symptoms.* Thus the method of the True Scent would be called into use.

A doctor armed with the knowledge of the *danger signs* of lack of the power of natural healing, would be able to tell young men or women who consulted him for, say, a cold or some other "trivial" ailment, that they were, in fact, in great jeopardy, and would thus be able to *prevent* the onset of consumption in these cases, or—supposing it to have begun in a very small way—to prevent its spread.

In other words, the real cause of consumption must be looked for at a period long antecedent to that at which the gross signs of the disease show themselves. At such early periods, there are no germs present which bacteriologists can identify, there are no shadows in the lungs which the X-rays can reveal. The doctor must rely chiefly on his five senses.

It will be seen that this is not, in any sense, an attack on bacteriology or on laboratory methods. It is an attack only on the absurd idea that these can replace the physician, or that the power to foresee or prevent danger can be won by ignoring the sick-room.

The giants might bow the knee to the laboratory and the Men of Germs; Mackenzie would not. He saw the "Science of Medicine" as a science separate and distinct from all others, and not to be subordinated to any machine or test. In other words, he saw life as he had always seen it, all his days, as the wonder of wonders.

But he was no enemy of the laboratory. On the contrary, he made frequent use of it, and kept in close touch with its progress. His quarrel was never with the bacteriologists, but only with the physicians who had so signally failed to understand the first principles of their own calling.

The giants, however, were about to obtain their revenge for his criticisms.

CHAPTER XXXII

A SECRET OF THE HEART

THERE called one day at 133, Harley Street, a little man with a very genial and a very earnest face. He was shown into Mackenzie's consulting-room.

"My name," he said, "is Waller—Professor Waller, and I have come to invite you to see an instrument which I possess."

That instrument was Einthoven's string galvanometer, which is now known, the world over, as the Electrocardiograph. Mackenzie welcomed the news, and saw the instrument. He realized that Professor Waller had not bidden him on a wild-goose chase. The thing was enormously interesting.

Waller was a physicist of great brilliance. He was able to show Mackenzie that each time the heart beats, an electric discharge takes place, and that this electric discharge can be communicated to the string of the galvanometer so as to set the string oscillating. He was, further, able to show that these oscillations can be photographed through a slit, by means of a camera which "travels" behind the slit.

The resulting photograph is rather like a pulse

tracing. It shows a "wave" made by the auricles of the heart, and another "wave" made by the ventricles. Thus it shows also, with great clearness, those abnormal conditions which were originally discovered by means of the Polygraph and the smoked tracings. The wave, for example, made by the auricles, the so-called P wave, is absent from the Electrocardiogram in cases of the Dangerous Type of Irregularity, *i.e.* of Auricular Paralysis or Fibrillation. In other words, the auricles are not beating, and so do not emit their usual electrical discharge.

Mackenzie hailed Waller's discovery as a most interesting confirmation of the work already accomplished. He saw that it was worth following up, but he felt that he was not the man to undertake this task. For the electrocardiograph seemed to promise further information only about a branch of heart-study concerning which he thought that he had enough information already. It did not seem to promise any further information about the response of the heart to effort, or about failure to respond.

This early view of the instrument Mackenzie retained till the end of his life. In the last edition of his great book, the proofs of which he passed a few days before his final seizure, he wrote:

"Some light can be thrown" (by the electrocardiograph) "upon abnormal actions of the human heart, but beyond this the great majority of the variations are beyond interpretation, and have become a field for much vain speculation."

He turned the study of the new machine over to his disciples, bidding them realize its limitations. They set to work with good will, and diligently explored the whole field. Sir Thomas Lewis published his famous book on the instrument and also a record of researches carried out with its aid which won for him an international reputation.

Mackenzie watched that work with deep interest. He entertained the highest possible regard for Lewis, and was immensely pleased and proud that a young man of such evident ability should be identified so closely with his own studies.

"Lewis," he told me once, "is a man of science of the very greatest distinction."

His voice thrilled as he spoke; it was like the voice of a father speaking of his brilliant son. And he had reason to be proud. There are few studies in the whole range of science more complete than those which Lewis carried out.

These studies were closely concerned with certain very strange structures which had recently been found in the heart itself; a small knot or "node" of peculiar-looking substance, situated at the spot where one of the great veins enters the right auricle, and another similar node situated between the auricles and ventricles, and connected with these latter by means of a band or "bundle" which could be seen to split into two branches, one for each ventricle. At first nobody knew what these structures were, or what office they performed, but presently the idea gained

acceptance that they originated and controlled the heart-beat, after the fashion of an officer in control of troops. Evidence was adduced to show the first of these nodes, called the sino-auricular node, was a "pacemaker," which regulated the beating of the auricles. The beat of the auricles excited, in its turn, the second node, the auriculo-ventricular node, which regulated the beating of the ventricles by means of messages conveyed along the band or bundle connecting it with each of these chambers.

Mackenzie's interest in this discovery was enormous, because it seemed to him to throw light on the fact, which he himself had discovered at Burnley, that the chambers of the heart not infrequently fail to keep step with one another. He therefore followed Lewis' researches, on the mechanism of the heart-beat, with the closest interest, and applauded them with generous enthusiasm. He was greatly excited when Lewis showed that the Dangerous Type of Irregularity, called by himself "paralysis of the auricle," corresponded to that fibrillation of the auricle which some workers had produced in experimental animals, and he welcomed the suggestion that the auricles ceased their normal beating because the pacemaker had ceased for the moment—for some cause—to exercise its wonted control over their activities.

Further, he saw that if the second node or pacemaker, or the band or bundle proceeding from it, was put out of action, the connexion between the auricles and ventricles would be

entirely cut off. He had already met with such cases in practice—cases in which the lower chambers of the heart—the ventricles—seemed to be beating quite independently of the upper chambers—the auricles. These cases he called "Heart Block"—the idea being that a block had taken place in the normal means by which the upper chambers called on the lower chambers to beat.

This enthusiasm, however, never for a moment blinded Mackenzie to the fact that the measure of the heart's power is its power to pump blood; that is to say, to respond to calls for effort. Diseases or affections of the pacemakers or the bundle—like diseases of the valves—were serious or not serious, solely according to their influence on the efficiency of the heart muscle. Had he not already discovered that a man with paralysed auricles, a man, that is to say, the upper chambers of whose heart had ceased to beat, might be able to carry on hard work over long periods of time?

CHAPTER XXXIII

"THE MACKENZIE SCHOOL"

LEWIS' researches with the electrocardiograph thrilled the giants of two continents. Here indeed was an instrument of precision! Loving eyes regarded its bulk and its mysterious details just as, earlier, they had regarded the buzzing clockwork of the Ink Polygraph. It became the aim of every "heart specialist" on earth to possess one of these imposing machines.

And no wonder! The electrocardiograph is the most impressive bit of apparatus which the wit of man ever devised. Imagine the feelings of a patient who, on his arrival at a doctor's house, is conducted to some dim apartment, and there told to thrust his hands or one hand and one foot into mysterious receptacles connected by electric wires with the dark monster at the other end of the room! It is an "electric picture" of the heart, of his own living, beating heart, which is being taken; every throb, every subtle movement is being written by that beam of light which quivers so mysteriously in the distance!

Imagine, too, the thrill of scientific ardour which the manipulation of such a wonder must

afford to any physician not imbued with the ideas of a Mackenzie!

All the hospitals on both sides of the Atlantic which could afford to buy them, installed electrocardiographs as soon as these became available, and researches of the most diversified kind were immediately begun by the help of this instrument. People said that Mackenzie was indeed a wizard—had not the electrocardiograph proved that his tracings and the interpretation thereof were correct? People also said that a new school of heart medicine had arisen, and they gave to it, in the fullness of their admiration, the name Neocardiology. The Man of Burnley awoke one morning to find himself a Neocardiologist!

In other words, he had become, by common consent, the Father or Founder of a "school." That fact, which was soon borne in on him, occasioned him a very comprehensible pleasure. His first feeling was that he was gathering about him young men of very great brilliance; his second, that all the weight of authority now attached to his teaching. It mattered no longer what the old giants might think; young men had been enlisted in every country. He saw, with a thrill of pride, investigations begun into the origin of breathlessness, and into the mystery of pain, and he followed with wrapt attention the exquisite work of Lewis and others in connexion with the manner of the heart-beat.

I do not quite know how long this period of satisfaction lasted, but I do know that, as time passed, Mackenzie began to grow a little restive.

He was immensely gratified by the research work, by the confirmation of his views which the electro-cardiograph had furnished, and by the new data which had been obtained by its intelligent use. But he began to feel that his "young lions," as he called them, were not devoting quite as much attention as he would have wished to the actual practice of medicine. They were becoming research-workers in physiology and pathology, rather than clinical students. The call of the sick-bed still rang in the great doctor's ears.

He mentioned this matter to some of them, and experienced a keen surprise when he found that they did not seem to apprehend his meaning. "Surely," they asked, "it is more important to carry out research work than to engage in practice?" Mackenzie felt a chill at his heart. He went back to his consulting-room with troubled eyes.

A little later, he spoke again on the subject to some of his intimates.

"But, my dear Sir James," he was told in effect, "you are the source of inspiration on which we have all drawn. You are the Founder of our work. Everything we are doing has come from the fountain of your actual practice."

The words were spoken in deep sincerity. The old doctor was fain to accept them. Perhaps, after all, he had underestimated the importance of research work of this kind. Had he not shown himself a dunce at his earlier contacts with academic study? That native humility which dwelt within his heart caused him to bow before

the opinions of the men whom he regarded almost as his own children.

And so the New Cardiology advanced, as a branch of Physiological Science, in a manner so brilliant as to win the admiration of the whole world. Everybody, everywhere applauded "the Mackenzie School." And everybody repeated the slogan that a new conception of medicine had been produced. "Is it not wonderful," they cried, "that all this splendid work should have found its origin in a country surgery? To think that that great brain should have been buried in general practice! What an escape!"

The Mackenzie School! The very words chilled the Man of Burnley. They compelled his thoughts to return to the Perth Academy, and to the weary days at Edinburgh University when he was under the necessity of committing to memory the facts which found no reasoned order in his brain. All his life he had been escaping from the tyranny of schools. That was the real explanation of the lure of the coloured lights in the chemist's window in Perth City; that, again, was the explanation of his going to Burnley to the house of Dr. Briggs. What impish fate was it which had decreed that he should be an architect of that very thing against which his spirit revolted?

He broke the silence which he had kept about the tendency of the work of many of his disciples. He tried to rouse them to an appreciation of the needs which he felt. Which of them would go out into general practice and continue there, in the daily round, the work he had begun? Was

there no answer? Could it be that he was speaking to specialists, to schoolmen, to disciples who had assumed already the academic mind?

I remember a meeting he had with a distinguished American doctor who asked me to introduce him to "the great Mackenzie." This devoted admirer talked to him about the electrocardiograph, and the meaning of the "waves" produced by it. He spoke a great deal about the "Q wave," and then, finally, demanded of his silent and unresponsive auditor:

"What line of research would you advise me to take up when I return home?"

Mackenzie's reply came in accents of some weariness.

"I would advise you to go into general practice and stay there for ten years."

The American doctor controlled himself with an effort.

"Do you mean that, Sir James Mackenzie?" he asked incredulously.

"Absolutely."

"But why?"

"Why? Because it is only in general practice that a man can learn how to foresee danger to his patient, and how to prevent it."

That doctor left Harley Street in utter bewilderment. He was not the only person who experienced this feeling after seeing Mackenzie. Some of the disciples were similarly troubled. They began to think the reiterated advice, "Get thee to general practice!" rather a bad joke. I

once heard Mackenzie say to one of them in sad tones:

"Oh, if only you had had *even five years* in a colliery practice!"

Protests of this sort, however, were as powerless to dispel the idea of "The Mackenzie School," as are a pair of bellows to blow away a fog. "The Mackenzie School" was a fact. What is more, it enjoyed the reputation of being the most academic and the most "scientific" school which Medicine had ever known. The very words which it employed to express its ideas were new-minted. They puzzled and bewildered the uninitiated. But they fascinated students and specialists. The School grew in stature and in strength. It adopted a remote and detached attitude, like the attitude of priests when engaged in the performance of their rites. It developed an exquisite technique in experiment, and a most rigid self-criticism. "Mackenzie," said those who had heard of him only by the hearing of the ear, "is indeed one of the giants."

And they supposed that they were paying him the very highest compliment.

It was true, though, what they said. In spite of himself, in spite of all his struggles to avoid that fate, Mackenzie had, for practical purposes and so far as the rank and file of his profession were concerned, become a giant.

He was, indeed, thanks to the immense vogue of "The Mackenzie School," and to the brilliance of its students, *the greatest giant of them all.*

His spirit grew heavy within him,

CHAPTER XXXIV

"THEY ALL LOVED THE MAN"

It must not, however, be inferred that Mackenzie was unhappy, or lacking in social pleasure during his London days. The reverse is true. He was enormously busy, incredibly successful (unless one realized that sick men and sick women can be trusted, always, to discover a real doctor). All financial anxiety had finally been removed from his life. His patients included a very large proportion of the distinguished folk of the day—the kind of people who understand and recognize a really big man. Moreover, practically all the established leaders of medical thought were his friends, his very good friends. He never carried his professional quarrels into private life.

Among those friends he valued especially the regard of Sir William Osler, of Sir Clifford Allbut, and of Sir Almroth Wright. Wright attracted him specially, perhaps, because that great man thought very differently from himself, yet closely resembled him in many ways. He entertained, also, a most lively affection for Sir Arthur Keith ("Whenever Keith looks at anything, he sees something nobody else had noticed; and when-

ever he sees it, he begins to 'wonder why'"), for the late Sir William Bayliss, and, indeed, for the whole company of the physiologists. Professor Cushny was another of his friends, and so was Sir Arbuthnot Lane ("Lane is a surgeon who thinks"). He and Lane, on one occasion, "got lost" in London. They had slipped quietly away together, like a couple of schoolboys, to a "movie show." Mackenzie was partial to this form of entertainment, and also to detective stories. Sir Robert Jones was another of his very great friends, and he never spoke of that genius without deep respect and affection. Their acquaintance extended back to the Burnley days. Sir Thomas Lewis, as I have said already, held a most exalted place in his regard, a place all his own, from which he was never removed. These two men did not always see eye to eye, and Lewis—or so Mackenzie told me—could not accept much of the later teaching. But Mackenzie glowed with pride in the great reputation of his disciple and friend.

The same affection went out to Dr. John Parkinson, his assistant and successor at the London Hospital. They were like father and son, and what "John" was doing was always a matter of eager interest to his Chief.

Of this company, also, were Sir Walter Fletcher, the distinguished Secretary of the Medical Research Council, and a man for whom Mackenzie had a sincere liking; Lord Dawson of Penn, who proposed the resolution which welcomed the Burnley doctor to the staff of the London Hospital;

and Sir James Purves Stewart, Dr. John Hay and Dr. Frederick Price. Further, if I may venture to include him among the members of that profession for which he has achieved so much on so great a scale, I should like to mention here the name of Lord Knutsford. He it was who placed the resources of the London Hospital at the disposal of Mackenzie. Mackenzie dedicated to Lord Knutsford one of the greatest books he ever wrote, *The Future of Medicine*, in these words:

"*To the Right Honourable the Viscount Knutsford, a zealous friend of medical science, whose interest in medicine is not only personal but hereditary, and whose devotion to the relief of suffering has led him to take an active and sympathetic part in the progress of medicine.*"

Nor can I omit from this record of Mackenzie's friends the names of Sir Dawson Williams, the editor of the *British Medical Journal*, and of Sir Squire Sprigge, the editor of *The Lancet*. Sir Dawson was one of the first men in London to recognize the Burnley doctor. Mackenzie often spoke of him, and always with the greatest affection and regard, as a fine journalist and a brilliant man. He delighted to send his papers to the *B.M.J.*, knowing that they would be read with a kindly, a discriminating and a sympathetic eye. Sir Squire, too, placed his paper at Mackenzie's disposal, and published many of his most important communications, notably those dealing with heart disease in relation to pregnancy.

I have left out many names, for Mackenzie's circle of friends was vast and ever widening. It included Americans, Frenchmen, Italians, Spaniards, Germans, Belgians and Dutchmen. It included, also, large numbers of those who attacked his views. For, though they might reject the doctrine, they all loved the Man.

CHAPTER XXXV

THE SOLDIER'S HEART

MACKENZIE as a "giant" was a figure of irony. Once again the uneasiness which had possessed him while a lad at the Perth Academy, began to trouble his soul. Once again he felt himself a "dunce" among all the mingling of physics and chemistry and physiology with medicine which was part and parcel of the New Cardiology. He began to experience that old, deep-seated hunger for life which had endowed the coloured lights in the chemist's shop with so alluring a glamour. He began to petrify his intimate friends by talking of a "return to general practice."

"If nobody else will go," he said to me once, "I must go myself. There is so much to be done. This work in London has made things possible. . . ."

The war, however, came to postpone that amazing project. And the war had not advanced far before it seemed as if the project might not require to be carried into effect.

For the war made a sudden and most emphatic call upon the medical men of this country, and, indeed, of all the belligerent countries to exercise the power of foreseeing danger. "Give us fit men," cried the recruiting authorities, "and

reject for us the unfit, who can only be a burden to the armies. *Foresee for us how the stress of training and of service will affect each recruit you examine.*"

The medical men of two continents got to work, and began the business of foreseeing danger, on the greatest scale on which it has ever been conducted since the world began. These doctors worked under test: that is to say, as soon as a favourable opinion had been expressed, it was put to the proof by the man being sent off to undergo intensive training. Thus, it was not long before the doctor's power of foreseeing was known. Let me quote Mackenzie:

"When at a time of great national stress a call was made for men to join the army, it was assumed by the nation, as well as by the military medical authorities, that there existed sufficient knowledge to separate the fit from the unfit. This was really a test on the greatest scale of the adequacy of medical knowledge. At the outset the knowledge was found wanting, for large numbers of perfectly healthy men were rejected because they presented signs whose value the medical examiners were unable to assess. Later, when the national strain became greater, and it was necessary that even those with impaired health should enter military service, the military authorities again thought they possessed the knowledge necessary to say what amount of physical effort a man was fitted for. It is unnecessary to dwell upon the complete failure that resulted. So glaring were the mistakes, so unjust were the decisions, that the whole nation was aroused, and Parliament was forced to intervene."

The situation in connexion with supposed heart disease had become specially bad, as early as the year 1915. At that period very large numbers of heart cases filled the military hospitals, both at home and abroad. Some of them were labelled "V.D.H.," which means Valvular Disease of the Heart; others were labelled "D.A.H.," which means Disordered Action of the Heart. Roughly speaking, this classification depended on the presence or absence of a murmur. If a murmur was present, the case was "V.D.H.," and the man was invalided out of the service and pensioned; if no murmur could be heard, it was assumed that the heart was sound, and the patient was put to bed to recover from his quick pulse or exhaustion, or whatever sign he happened to show. There were tens of thousands of these fellows, and most of them were quite young men. The position became so bad, that an appeal was made by the military authorities to the Medical Research Committee which had been set up only a year or two before. Sir Walter Fletcher, the Secretary of that Committee and himself a distinguished physiologist, promptly appealed to Sir James Mackenzie and Sir Thomas Lewis for help.

The appeal amounted to this: "Tell us how we can foresee danger of heart trouble in recruits, and tell us how to deal with these people." This was the age-old demand of general practice, and Mackenzie realized with a thrill of excitement that, in spite of themselves, his disciples had been summoned to the work of general practitioners.

He met them, to discuss ways and means, and it instantly became apparent that what he had been insisting on for so long was not merely one of his own ideas, but an urgent practical necessity. His disciples obtained a sudden revelation of his meaning.

"You will find," he said, "that many of these cases of supposed heart disease will show signs of failure to respond to calls for effort. But these signs will not, as a rule, be the same as the signs I have been accustomed to call the signs of heart failure. For example, in true heart-failure cases, cessation of effort relieves the patient immediately either of his pain or his breathlessness. He feels quite well and feels able also to undertake various forms of exertion. Such effort as lies within his capacity he can perform without any feeling of discomfort. In many of these cases, on the contrary, though attacks of pain and breathlessness may occur, the patient does not feel that sensation of well-being when effort is relinquished. He feels exhausted, or has other vague or indefinite sensations by which he knows that he is not well. His pain, too, often comes on while he is at rest.

"Such persons are not suffering from heart-failure, but from poisoning by some disease. This fact will be revealed to you by a study of the history of the trouble. which, you will find, has, in the majority of cases, begun after some illness or is actually occurring simultaneously with some illness."

A preliminary examination of some four hundred cases was carried out, and this forecast was proved to be correct. Over eighty per cent. of the cases of so-called "soldier's heart" (the

type included V.D.H. and D.A.H. cases) were found to be sick men whose most prominent symptom was a sense of exhaustion, and who presented evident signs of ill-health. In many cases this could be traced to an infection, for example, trench fever, rheumatism, dysentery. Some of them were breathless on exertion, and some had severe pain over the left chest, but all these, on ceasing from effort, or being relieved of excitement, continued to feel ill and exhausted—thus bearing out Mackenzie's statement that they would not show the real signs of heart failure, pain and breathlessness of a progressive kind induced by effort and relieved completely by its cessation.

The War Office, impressed by this work, opened a special hospital at Hampstead for the study of "soldier's heart." Mackenzie, Osler and Allbutt were appointed consulting physicians to it, and Lewis, Parkinson, Francis Fraser, Cotton, Levy and others were attached. Mackenzie submitted the proposal that, as the majority of the patients were not suffering from heart failure, or indeed from any form of heart disease, they should be encouraged to play games. He stated that he had found, at Burnley, that such patients improved very much when they took pleasurable exercise in the open air.

This idea was adopted and, in addition, a Sergeant Instructor was obtained—again at Mackenzie's suggestion—to give the men physical exercise. The step caused a good deal of uneasiness to the men themselves, many of whom

believed themselves to be hopeless cases of heart disease, and so the earlier exercises were attended by the whole of that brilliant staff. In spite of the anxieties of the supposed victims of heart disease, nothing happened. And, as time went on, it was found that many of the men improved considerably in health as a result of their out-of-doors efforts.

In other words, Mackenzie's views of these cases were substantiated to the hilt. He expected that the experience would recall his fellow-workers from their pursuit of physiology and other sciences to the study of medicine; that is to say, to the search for further powers of foreseeing danger. He was disappointed. The work at the Heart Hospital at Hampstead became highly specialized. Efforts were made to discover the chemical reactions lying behind the breathlessness evinced by some of the patients, and also to test the effects on the cases of such preparations as adrenalin, apocodeine, and acetyl choline. I played a small part in carrying out some of these last investigations, and I can remember describing the results to Mackenzie with enthusiasm—for I had not then fully grasped his principles. He shook his head.

"All very interesting, no doubt," he said, "but not medicine."

I felt greatly crestfallen, and I suppose a little upset. Then he told me that there were aspects of this "soldier's heart" problem which were troubling him very much, and that he had failed, so far, to obtain any solution. He was so earnest and so kind in his manner, that my ruffled feelings

were completely restored. So far as I know, the work we did at Hampstead has produced no result of any great importance. As Mackenzie said at a later period:

"If one looks at the post-war writings for any evidence of an addition to our knowledge as a result of this research, there will not be found any fact of the slightest importance which throws new light upon any form of heart trouble."

Indeed, the only thing that "stood" in all that work was the value of mild exercise in certain cases, though doubtless the immediate purpose of separating severe from less severe cases was served. In other words, it was the prescription of the Burnley doctor—"give them games and exercise"—which held the field throughout the whole period of the study, so far, at any rate, as the treatment of the patients was concerned.

That experience, in the end, opened my own eyes. I began to understand what I had not understood before—the real significance of Mackenzie's insistence on the actual practice of medicine.

Mackenzie himself was still brooding deeply and continuously on the symptoms presented by these young soldiers. He asked me, I remember, on one of the occasions when I visited him, why the presence of a poison in the system, for example trench fever, should give rise to symptoms such as breathlessness and pain, and he told me that he had spent anxious years at Burnley, before he had been able to make sure that such breathlessness

and such pain did, in fact, arise from a different first cause than that operating to produce the breathlessness and pain of heart failure. He said:

"It was because I had carried out that prolonged study that I was able, when I saw these cases, to recognize their true character. But I am still far from knowing why they show the symptoms they do show. Their hearts are sound. Whence, then, that pain over the heart which may, and often does, occur in bed, and whence that breathlessness?"

On another occasion, he asked:

"Have you found my observation that these men are always, even when at rest, aware of a sense of ill-health and exhaustion, a correct one?"

"Yes. They say they feel 'rotten.'"

"Whereas the man with failure of the heart feels splendid when he stops trying to do things which bring on his pain or his breathlessness?"

"Yes."

He sat silent a moment, and then remarked:

"The sense of exhaustion is a very early sign of ill-health; but it never points to heart failure, I think. What a tragedy that we know so little about its real character!"

I could see that his mind was yoked to a fresh problem. He added:

"For years I have been groping in the dark for some general law which would enable me to classify symptoms according to their affinity in nature."

I was yet to learn the deep significance of these last words.

CHAPTER XXXVI

THE EXCITEMENT OF THE FUTURE

When Mackenzie first told me that he was going back to general practice, I thought he was joking. Even when I realized that he meant what he said, I told myself that I need not take him too seriously. People, I remember thinking, do not do such things, however much they may talk about them.

I did not know my Mackenzie. And in those days my views about medicine and its needs were the views I had been taught at college. In those days, I thought that "to get into Harley Street" was to reach the very summit of a doctor's ambition.

But now, looking back, I can see how inevitable it was that the Man of Burnley should return to the practice of medicine. We were all blind, all those of us who enjoyed the rare and splendid privilege of knowing and hearing him; he alone saw clearly. While we played with our polygraphs and our science, his eyes looked out into the future and his ears heard the immemorial questions of the sick and suffering: "What does this sign mean for me, doctor? What must I do to regain my health?"

His work in London had served its purpose.

It had drawn the eyes of the world to his researches. But it had hindered also, because out of it had arisen "The Mackenzie School," the new cardiology with all its academic obscurity. And the disadvantages were beginning to outweigh the advantages. Mackenzie, the giant, was impotent to pursue the labours which awaited him. He was surrounded, deified, smothered in a "science" which he knew not. Shackles were upon his arms. Even his voice was silenced by the voices of those who were regarded as his disciples. Men used his name, quite honestly, in connexion with work the very nature of which was foreign to his understanding.

Nor was there any hope for the future while he remained. These young men, whom he loved and admired, were really separated from him by an unbridgeable gulf. They belonged, in their hearts, to what is called "scientific medicine"; the needs of general practice were utterly unknown to them. They had never practised medicine in the sense in which Mackenzie understood that phrase. They had not been family doctors; they had not looked on the intimate and elusive face of disease. And so, though they had tried to understand him, though they had been at great pains to adopt his point of view, they had failed.

I confess that I think there is much of pathos in that spectacle of the old man, become the high priest of a new cult, and surrounded by his disciples, yet preparing to flee away. He was again, as he had been at Burnley, a lonely figure. And this last loneliness was greater than the first.

Once more, the necessity of marching out into the unknown stared him in the face.

There was no other way. To remain in London would be to acquiesce in the New Cardiology and the "Mackenzie School." It would be to accept gianthood, to become an oracle speaking through the mouths of priests, to bow before those false gods, the polygraph and the electrocardiograph, and all that they represented. His principles would be lost in utter oblivion.

He felt, as perhaps all great teachers have felt at certain moments of crisis in their lives, that they stand far removed from ordinary aims and ambitions. Harley Street meant nothing to him, except as a means to an end, nor was he concerned to know what people would think of his action.

"Most likely," he observed once, "they will say that I have become crazy."

Some of them did say that.

Behold him, then, one night in the year 1918, when the Great War was drawing to its close, and when he himself was sixty-five years of age, leaving his consulting-room in Harley Street for the last time. Nobody knew that he was going. He went unperceived, just as he had come. He left behind him a practice worth rather more than £8,000 a year and ever increasing — a practice which, had he cultivated it during the seven years which remained to him of life, must have brought him a fortune.

But it was not money which he sought or had ever sought. He had earned enough to be able to devote the remainder of his life to research,

and to be able to pay for that research himself. He had earned, too, that distinction which, while it hampered him in London, would help him as a general practitioner. The work that he was going to do would not lack for attentive observers.

He closed the familiar door, and the war-time gloom of the famous old street swallowed him up, a tall figure, unbowed by the years. The voice of London sounded gently in his ears—this great London which had taken him to her heart, as she takes all men whose spirits are attuned to her majesty. He heard it, as an active citizen of London, for the last time.

I like to think that, as he came to the end of the street on his way to Baker Street Station, he turned about for a moment remembering the feelings which had brought him to this place. And I like to think that then, with that wonderful smile on his lips, which remained an unsullied heritage from his boyhood, he resumed his way without regret. So, and not otherwise, had he gone forth from the Perth Academy, from the chemist's shop, from the University of Edinburgh, and from his home at Bank Parade.

The excitement of the future was in his eyes.

BOOK IV

"THE MAN"

"He was a man, take him for all in all;
I shall not look upon his like again."

CHAPTER XXXVII

ST. ANDREWS

MACKENZIE returned to general practice, in order to study the earliest symptoms of disease. He announced this object very soon after his departure from Harley Street, and the whole world applauded him. The expression "earliest symptoms" became a kind of slogan. The giants, bewildered but relieved, told each other that it was certainly very important to recognize disease at the very earliest possible moment.

Was this not, after all, exactly what they themselves were doing? By the use of X-rays, for example, the earliest shadow of approaching tuberculosis might be detected. By the giving of a test meal or a bismuth meal, the earliest signs of trouble in stomach and bowels were made manifest. They wished Sir James Mackenzie well of his enterprise.

Mackenzie replied that the earliest symptoms of disease, as he understood the term, were *the feelings of men and women.* He asked, "Can you detect these with X-rays or a bismuth meal?" His work at Burnley had shown him that there are immense numbers of sensations which disturb the comfort of healthy life and had suggested to

him that each of these sensations possess a meaning both for the present and for the future. He meant, if possible, to discover these meanings so that he should be able, in course of time, to say which of the sensations were of serious import and which not, and so be able to foresee the coming of disease long before it had overwhelmed its victim.

He had already made a little progress in this direction. He knew, for example, how to distinguish between the breathlessness of heart failure and the breathlessness of a poisoned system. He could discriminate between a victim of the "soldier's heart" and a victim of heart-muscle failure. But how little that was, after all! For by the time heart failure had begun, the patient was crippled permanently. By the time the "soldier's heart" (which is the same as the so-called poisoned or nervous heart of civil life) had arisen, its possessor was a very sick man indeed. What were the earliest signs of heart disease? Or rather, what were the signs of a tendency towards heart disease?

That question recalled the fact that many cases of heart disease can be traced back to rheumatic fever or rheumatism, or to some other infection. What, then, were the signs of a tendency to rheumatism? What, to go no farther back, were the signs of rheumatism itself?

Mackenzie did not know. He remembered that at Burnley he had seen many feverish attacks occurring in children and also in adults, the nature of which was hidden from him. Some

of these patients had afterwards developed signs of rheumatism, in the usual acceptation of that term. Some had become nervous. Later on, some of the rheumatic or nervous people had developed heart troubles. In other cases, however, the feverish attacks had passed, leaving no ill effect.

Very often, after these attacks, the patients had shown quick pulses and been breathless and also exhausted. What was happening to produce these symptoms ? That question led to another : Why, in ordinary, everyday life, does the pulse often beat quickly ? Unless one knew this, one could scarcely hope to understand why it beat quickly after attacks of illness. Again, why do healthy folk get breathless when they run far or fast ? And how do they get breathless ? Why is exhaustion experienced by fit people who have been subjected to very great strains or stresses ? What is exhaustion ? How does it arise ?

Mackenzie had discovered to his amazement, that he could not answer one of these questions. He did not know by what means effort normally increases the rate of the pulse, nor by what means runners normally get " puffed," nor how nor why spent athletes sink down exhausted.

In other words, he did not know the mechanism of the simplest signs or symptoms. He could not tell what parts of the body were involved in their production, whether the muscles or the nerves or the heart itself. He could not even tell where the starting-points of these symptoms lay. When a man runs, for example, his heart at once begins to

go faster; it is "stimulated" to increased activity. By what is it stimulated?

He saw, therefore, that before he could extract useful information from the earliest symptoms of disease, he must know how these symptoms are produced; how, that is to say, the ordinary, everyday "feelings" and sensations of ill-health arise and the organs or structures concerned in producing them. Again, he must know how they develop. He must "wait and see." But over and above all this, he must have a guiding principle, a "true scent" to enable him to arrange his ideas. For example, it was not enough to know that a particular symptom occurs in some ailment, nor yet to know the structures of the body concerned in producing that symptom. *He must know, also, whether or not the health or the life of the patient depended on the integrity of these structures.* "*What is there to fear?*"

Unless he knew this, he would waste his labour.

For the number of symptoms is limitless. If he knew this, he would be able, by studying the *danger symptoms*, to foresee danger and perhaps combat it.

He asked himself: "What are the structures of the body on the integrity and strength of which life and health depend? The heart muscle is one of these, and there are, as he saw, several others. A symptom, therefore, in the production of which the heart muscle was concerned, for example breathlessness on effort, must be a danger symptom, a real *warning sign*. A symptom, on the contrary, which did not involve this muscle nor

any other structure on which health or life depended would not be a danger symptom.

His first necessity was to obtain the help of men possessed of opportunities for studying the earliest symptoms of disease. The only men possessed of such opportunities are general practitioners, because patients go, in the first place, not to consultants, but to their family doctors. The second necessity was to obtain that help in some locality where the population is resident from one generation to another, so that the fruits of the method of "wait and see" might not be lost by the removal of patients from the district. The third necessity was to set up an institute or meeting-place where the study might be centred, where records might be kept, where views might be exchanged, and where patients might be examined.

Mackenzie chose the Scottish town of St. Andrews as the scene of his new labours, partly because it is situated but a short distance from his native Perth, and partly because it stands more or less isolated from the world. It fulfilled his requirements and possessed, in addition, a medical school attached to its ancient university. Moreover, it offered him the opportunity of playing his beloved golf on the greatest course in the world.

He travelled to St. Andrews, bought a house there, and addressed himself to the task he had set before him.

CHAPTER XXXVIII

A MAN'S MAN

SHORTLY after he left London, Mackenzie suffered the loss by death of that brother with whom he had shared rooms in Edinburgh during his student days. His brother, who was a minister of the Scottish Church, died in his pulpit one Sunday evening of angina pectoris.

He had been a much-beloved clergyman, and was a writer of distinction, his *Life of Dr. John Brown of Haddington* having achieved a wide circulation.

Dr. John Brown was a relative of the Dr. Brown who persuaded James Mackenzie to begin practice in Burnley.

Mackenzie attended his brother's funeral, and told me afterwards that he was surprised at the number of men who also attended.

"I asked one of them," he said, "how this had come about, and he replied, 'Your brother was a man's man, a man's minister.'"

That description, *a man's man*, exactly fitted Mackenzie himself. His early days in St. Andrews showed clearly how well it fitted him. He appealed to the doctors of the town simply as man to man, and he won them all—though it had been prophesied that he would fail to do this.

He visited them individually, and asked them to allow him to help them as though he were asking the greatest possible favour. He felt that he was asking the greatest possible favour, for the humility of the man was as big as his courage. Some of these doctors have told me of the thrill of wonder with which they heard him. Here, on their doorsteps, stood the most renowned physician of his age, a man whose name had become almost a legend, asking to be permitted to undertake, on their behalf, a little of the burden of family practice in a small Scottish town. It took their breaths away.

Mackenzie thought at first of putting his name on the panel, for he had the greatest faith in the panel service, but, on second consideration, he decided that it would be better to remain a private individual. Instead, therefore, he accepted an appointment which was, I think, one of the most valued he ever obtained. In the year 1918, this Fellow of the Royal Society, this Fellow of the Royal College of Physicians of London, this Consulting Physician to the London Hospital, became also Consulting Physician to the St. Andrews Cottage Hospital. He entered immediately on the duties of his office, by beginning weekly out-patient clinics at which he saw patients brought to him by the general practitioners of the town. These clinics closely resembled those he had held on Sunday afternoons at Bank Parade. They attracted doctors from all the surrounding country. Discussions took place, and plans were drawn up for the creation of an Institute for

Clinical Research. The first general meeting of the staff of this Institute was held on September 5, 1919, when the following resolution was passed :

" The main objects of research would be the early stages of disease, and the work would primarily consist of detailed observation of symptoms and the keeping of careful records. Prolonged observations of cases would be carried out in order to discover the significance of early symptoms, and researches would be undertaken with a view to ascertaining the mechanism of their production."

Mackenzie addressed the doctors, who were his fellow-workers, in these words :

" During the past year at the hospital " (the Cottage Hospital) " we have been having weekly meetings, and I have demonstrated to you the presence of symptoms usually overlooked or misunderstood, and have shown how little we know of the essential matters connected with symptoms. This was done for the purpose of impressing you with a particular defect in our knowledge, so that you might value the need for an investigation into disease in a manner not yet systematically pursued.

" One of the greatest difficulties I have had in getting hospital physicians to understand what I am driving at is, that I have been looking at the subject for thirty years from a point of view they have never seen ; for the investigation of disease, as it presents itself to the general practitioner, has led me to see the symptoms of disease from an aspect different from investigators in other fields.

The elementary principles of research in disease have, therefore, to me, a meaning different from that which is usually accepted.

"Before I recognized this fact I felt somewhat disappointed in the neglect of the work I had done, and the misunderstanding of my results. Moreover, I found that the young qualified men, many of whom had been trained in laboratories, could not understand the principles which guided me, and I found, in later years, when they recorded their own observations, that they had not grasped the significance of what I had observed.

"I now recognize that my ideas were the result of over thirty years' observation and study; and, while they seemed to me clear and simple, yet those who had not had a similar experience could not grasp my point of view. Recognizing this, I saw that I must look for assistance to those who had undergone experiences similar to my own, and it is for this reason I seek the help of the general practitioner in this research.

"The reason, therefore, I have asked you to join in the investigation, is because you have the opportunity of seeing disease in the human subject in all its phases. As family doctors, you have the opportunity of knowing the individuals before they became stricken with disease, of seeing their surroundings and their mode of life. You are consulted at the first appearance of ill-health, and you see the patient through the whole course of his illness."

He closed his address with these words:

"I must warn you against any immediate expectation of achieving the chief aim of medicine,

the prevention and cure of disease. A long and weary road has to be travelled, and many of us will fall out before that is achieved. As I have said, we have first to train ourselves in the detection of symptoms. Our immediate object, after training ourselves, is to find out the nature of the symptoms of disease, by discovering their mechanism and by watching individuals to see what happens. It may be we may detect, in this way, the onset of some diseases. After that, we shall have to search for those who show the early signs of a particular disease, and, recognizing these signs, seek then for the cause and the factors that favour onset.

"Such a contemplation of our work seems discouraging, for we all like to see the fruits of our endeavours. But it must be borne in mind that all great enterprises are based on work that has been done by individuals whose past is lost in oblivion. Someone has to do the obscure but necessary work of digging a foundation, and if it falls to our part, we must be content with the knowledge that we are playing a necessary part in a great enterprise."

CHAPTER XXXIX

ONE OUT OF THREE

The St. Andrews Institute of Clinical Research, the name of which has now been changed to the James Mackenzie Institute of Clinical Research, is a substantial house, in that terrace which stands immediately above the Royal and Ancient Clubhouse. Its windows command the North Sea. Looking out from them, one views on most days a mighty sweep of racing waters, spread to the horizon. The view, indeed, is bounded only by that far horizon of the sea which seems always to beckon those with the sea-love in their hearts.

I thought, when first I stood in the long consulting-room of the Institute, how well that spectacle accorded with the mind of the man who was acting as my guide. Mackenzie always impressed me with his bigness of spirit. There was something elemental in his character which produced in those who met him a strange, deep excitement, like the excitement which some feel on gazing out over great waters, or in watching the passing of the high clouds when they go sailing over the sea. He seemed to belong to dim purposes, which were hidden from other men, as though he were a citizen of the future rather than

of the present. He seemed to pass on his own occasions as tall ships pass, going from darkness to darkness.

I felt that sense of the elemental in his character very acutely, I remember, on that day of my first visit to his beloved Institute, as I stood, with him, looking out over the Northern Sea. This was something strange and very big which he was doing; but something, also, which I found it difficult to realize clearly. The very simplicity of his ideas was bewildering—that constant insistence that the aim of a doctor is the prevention of disease, that disease is made manifest only by its symptoms, that in the early symptoms of disease lies the key to the fore-knowledge of danger. He left me, and went to a table in the room. The sunlight fell on the moving face of the waters, striking them with shafts of gold. The white clouds became fairer, more inscrutable than they had been before. . . . " the prevention of disease . . . the earliest symptoms of disease. . . ." I heard him coming back to me. I turned to meet him.

" Do you know," he asked, " how we have defined the object of our work? We have defined it as *the prevention of the diseases that are common among the people.*"

I think it was at that moment that the scales first fell from my eyes. The question sprang unbidden to my lips:

" What are the diseases that are common among the people? "

I did not speak it, but a moment later I had

my answer. They had, it appeared, begun their work by trying to make a list of common diseases. And they had made, instead, a discovery—that such a list could not be made at all.

"Will you believe it," Mackenzie said to me, "we have found that we can give a definite name only to about ten per cent.—one in ten—of the sicknesses which come before us. For every case which can be labelled positively, for example, as measles or scarlet fever, there are ten which cannot be labelled, except by calling them by the name of the most prominent symptom."

He mentioned angina pectoris, neuralgia, headache, bronchitis. Then he bade me sit down, and disclosed to me the six classes of disease.

"No. 1," he said, "consists of those ailments which are most thoroughly understood. An example is an inflamed eye caused by the presence of a foreign body, a grain of sand, in the eye; another example is the colic caused by the passage of a stone. Some of the diseases caused by germs may be examples, but we want to know why germs which are nearly always present in or about the human body, for instance, the germ of pneumonia and the germ of 'consumption,' are able to strike down some few people. We think that some element, hitherto unrecognized, must play a part in enabling these germs to become dangerous.

"Class No. 2 consists of diseases which are probably due to germs, but in connexion with which no germ has, as yet, been found; for example, influenza and rheumatic fever. Class No. 3 includes diseases which may or may not be

due to germs, *e.g.* asthma. In Class No. 4 we place angina pectoris, auricular fibrillation and cancer—diseases which probably follow some other, known or unknown, disease. Class No. 5 includes such diseases as have been recognized only by a single symptom, for example, constipation. This symptom gives no clue at present to the underlying condition. In Class No. 6 we place those symptoms which seem to be uncoordinated, for example, bilious attacks and neurasthenia. Adding our Private Cases to those seen at the Institute, we have examined about one thousand persons in order to make this classification. We find that 11 per cent. fall into Class No. 1, 2 per cent. into Class No. 2, 9 per cent. into Class No. 3, 6 per cent. into Class No. 4, 22 per cent. into Class No. 5, and 50 per cent. into Class No. 6."

He paused and looked up.

"In exactly half the cases a doctor sees in practice," he declared, "he is unable even to piece together the symptoms shown to him so as to make a rational diagnosis. *In about three-quarters of the cases he sees, he cannot make a diagnosis worth calling by that name—for 'constipation,' to take but one example, is not a diagnosis.*"

His face was troubled, as if this disclosure of ignorance had filled him with dismay. He introduced me to Dr. Andrew Rowand, who has written a remarkable paper on this subject of unrecognizable disease in the first volume of that amazing treasure-house *The Reports of the St. Andrews Institute for Clinical Research*, and also to Dr. Orr, Dr. Bryson, Dr. MacTier, Dr. Paton,

his greatly valued colleagues, and Professor Herring, who so constantly helped him. Then he took me over the building.

He was a boy again now, glowing with delight, fired by enthusiasm. I had never seen him so happy in my life. He opened one of the doors and glanced in to the empty room beyond. A smile broke on his lips.

"This is to be our laboratory," he said. "We are not going to despise the help which that kind of science can give us. But we are going to use it—it is not going to use us." Then he became grave suddenly, and asked me:

"Why, do you suppose, are we unable to say definitely what is wrong with three out of four of the folk who consult us?"

"I don't know."

He sighed. "I think," he remarked, "that I have a faint idea. Disease makes itself known by its symptoms. Unless we understand the mechanism of symptoms, unless we know what happens to those who show them, unless, above all, we know which are serious and which are not serious, we cannot form any correct ideas. Notice, too," he added, "that the symptoms which enable us to give a name to a disease—the rash of measles, for example—are not usually those which enable us to foretell danger in connexion with it. It is not the rash of measles which is dangerous, but the broncho-pneumonia which so often follows it."

On the way back to his beautiful home, New Park, he took my arm and told me that an old woman, a native of the town, had been heard to

remark when, on one occasion, he passed her door:

"There's the auld doctor frae London wha has garred the doctors here ken that they ken naethin'."

There was a giant, it seemed, even in St. Andrews.

CHAPTER XL

THE CALLING AND RESPONDING ORGANS

HAVING satisfied themselves that, to quote the old woman I have mentioned in the last chapter, they "kenned naethin'," the workers at St. Andrews set themselves to make records of their patients' symptoms—that is to say, to begin a new study according to the method of "wait and see."

They had scarcely begun before they were compelled to stop. What were they to record?

Mackenzie had fully expected this "check." He had just had a tussle on this very subject with that great man, Sir Robert Morant, the Chief Secretary to the Ministry of Health. Morant wanted to set up a system of record-taking for panel doctors, and appealed to me to arrange a meeting between himself and Mackenzie, of whose work he had heard. The meeting took place in my house in London, which Mackenzie was then visiting. Morant stated his case; Mackenzie promptly told him that he was pursuing a rainbow.

"The records you want, Sir Robert Morant," he said, "cannot be obtained at present, because most of the patients a panel doctor sees are suffering from ailments in which there are no definite physical signs to record, or in which the

signs have no real relationship to ill-health. The symptoms are subjective, they are feelings and sensations; and long experience has taught me that, to make records of any value of feelings and sensations is a difficult business. No doctor who has not had a special training can possibly do it."

"But, my dear Sir James, we cannot wait till we have trained our doctors. Surely you don't dispute that any records, however bad, are better than no records?"

Mackenzie's face was troubled.

"Yes," he said, "I do dispute that. At present we have no guiding principle, and so the nature and significance of feelings and sensations are not known. No two doctors would record the same phenomena or attach to the same phenomena the same significance. The result would be confusion worse confounded."

Morant, who was one of the tallest men I ever saw, as well as a very fine man, rose and stood by the fire. He thought a moment in silence.

"I am not a doctor," he said, "but I am advised by doctors that record keeping would be valuable."

It was manifest that he had made up his mind. Mackenzie saw that, I think, though he laboured hard when he returned to St. Andrews to draw up a scheme for the panel doctors which should be the means of avoiding disaster. But his advice was disregarded. In spite of the protests of the lay press, which, to its great credit, opposed the whole business, a committee was set up and a

scheme of record-taking instituted. Many panel doctors objected. Their objections were overruled. The medical press endorsed Morant's policy—with, I think, singular blindness. Can anyone say to-day that these records—that vast bulk of records—has added one jot or one tittle to our knowledge of the first causes of disease?

Mackenzie wrote, of the present scheme:

"It is perfectly manifest that it is useless, but it is hopeless to get the authorities to see that no one knows how to keep such records. . . It would be far better to spend a fraction of the money which is now being spent in this vain and useless manner, to obtain a method of record-keeping. It must be apparent to everyone that properly kept records by panel doctors would be of inestimable value."

He was determined that what had happened to the country as a whole should not happen at St. Andrews. A special course of training in the record taking of feelings and sensations was begun, and two hours daily were devoted by each member of the staff to taking one case only. In many instances, two hours were found to be insufficient for the work. Each doctor selected suitable cases from his private practice. All cases were fully discussed by the whole staff at a weekly meeting, and a professional diagnosis made. Then each case-record was typed in duplicate, filed and indexed. One copy was placed in a fire-proof safe, to make sure of its permanence.

Side by side with this improved method of "wait and see," the work of studying the mechanism of symptoms went busily forward. Very simple symptoms were chosen, to begin with. A colic pain, for example, would be examined. Mackenzie pointed out that, while the pain persisted, the skin was tender over a patch of the skin of the belly-wall, and that the muscles of the body-wall might be felt to harden in this area. He pointed out that the skin was not in any way inflamed, and that evidently there was no disease of the body-wall. How then this tenderness and hardening? For there is no obvious connexion between bowel and body-wall.

The conclusion was, of course, irresistible that the action of the bowel which gave rise to the pain had influenced the nervous system so that impulses were passed along the nerves to the spinal cord and thence to the muscles and skin of the body-wall. In other words, this activity of the bowel was provoking a response in structures far separated from it.

"You will see," Mackenzie said, "that three structures are involved—the bowel, which is so active as to throw out impulses into the nervous system, the nervous system which conveys those impulses, and the body-wall which responds to them."

He went on to say that the study of other symptoms had shown him a similar state of affairs—that there were involved three sets of structures in the production of each symptom,

structures giving rise to impulses, structures conveying them, and structures responding to them: "calling structures, conveying structures and responding structures."

Further study at the Institute confirmed this finding. There was evolved what was described as "The Principle of the Reflex Arc"—that is to say, the principle that impulses or calls produced by one set of organs evoke responses in other sets of organs after being conveyed to these other sets. The ringing of an electric bell, to use an analogy, may be evidence that somebody, far away, is pressing the button. The unwonted or untimely ringing of the bell may thus afford a clue to a change in the behaviour of a distant individual. It may also, however, indicate a short-circuit in the connecting wires or some derangement of the bell itself.

Here, in the idea of *calling and responding organs*, seemed to be a means of indexing symptoms and so bringing some order out of chaos. It might be possible to say that certain symptoms were due to defects of the calling organs, others to defects of the conveying organs, and others to defects of the responding organs.

There were, however, as it soon appeared, serious objections to this way of separating one symptom from another. The most serious objection of all was that the same organ may, at the same time, give forth a call and make a response to a call given forth elsewhere. It may even, in addition, convey a call. Thus the skin over the left side of the chest becomes tender during some

attacks of angina pectoris. In this case, the skin is acting as a responding organ. But touching the tender skin may, in certain instances, cause an attack of angina pectoris. In this case the skin is acting as a calling organ at the same time as that at which it is acting as a responding organ. It became necessary, therefore, to think of some other method by which symptoms could be arranged in a rational order.

Mackenzie devoted long hours of thought to this matter, and could see no light till, one day, it occurred to him that every process of life depends not only on the activities of living structures, but on the degree of these activities. An organ of the body may be a calling organ, or a conveying organ, or a responding organ, or all of these kinds of organs at the same time. But an organ cannot, at the same time, be too active and too sluggish. Some symptoms were certainly an expression of excessive activity of organs, others of sluggishness, others again of deranged activity or actually of the cessation of activity altogether. It was possible, further, to apply this method of discrimination according to the principle of the calling and responding organs. Thus, one might say that a symptom was due to the increased activity of an organ acting as a calling organ, *e.g.* the hardening of the muscles of the body wall in a case of severe colic, or one might say that a symptom was due to the decreased activity, the sluggishness, of an organ acting as a responding organ, *e.g.* an inactive bowel. Again, one might say that a symptom was due to the cessation of

activity of an organ acting as a conveying organ, *e.g.* paralysis of a muscle following damage to its nerve supply.

This idea of a classification of symptoms based on the activity or lack of activity of organs, and on their special forms of activity, was carefully worked out at the Institute, and yielded results of a most promising kind. The paralysis of muscles was studied, as a beginning, and it was seen that the application of the new idea to this everyday medical problem threw a flood of light on it. It was noticed, for instance, that a paralysed muscle twitches and shows many signs of being actively alive. But it does not make its usual responses in accordance with the needs of the body ; it does not, that is to say, contract or pull. It shows, in other words, a deranged activity. It is alive, it is active, but it is not normally or usefully active. Deranged activity points at once to lack of control, to lack, that is to say, of influences normally exercised over the muscle. Thus, the cause of the trouble is evidently to be looked for in those structures which in the healthy body regulate and control the activity of muscles.

It has already been pointed out in these pages that, when the Dangerous Type of Irregularity of the pulse is present, the auricles, or upper chambers of the heart, are paralysed. They do not beat. But they do twitch or "fibrillate." They are therefore alive. By applying the Principle of Increased or Decreased or Deranged Activity, it is at once seen that the cause of this purposeless twitching will not be found in the

upper chambers themselves, but will, probably, be found in those structures which normally regulate and control the beating of these chambers. These structures have been worked out for the heart, as has already been stated. That one which controls the beatings of the upper chambers is the node or knot of tissue lying at the point of junction of one of the great veins with the auricle, the sino-auricular node or Pacemaker. Hence it can be inferred that auricular paralysis is due to *decreased activity of the Pacemaker.*

But this first Pacemaker acts also on the second Pacemaker, and on the band or bundle which connects that structure with the ventricles or power chambers of the heart. Hence one might, in cases of auricular paralysis or fibrillation, expect to find disordered activity of these chambers also. One does find this. The ventricles beat, usually, in an irregular, feeble and rapid fashion (the Dangerous Type of Irregularity). Should the first Pacemaker recover or resume its full activity, the auricles at once begin to beat and the ventricles resume their normal rhythm.

The uncontrolled, paralysed auricles are bad enough. But the feeble-beating of the ventricles is much worse, from the point of view of the patient's health. Hence it follows that the most serious feature of these cases is not the lack of control of the first Pacemaker over the auricles or upper chambers, but the lack of control of the first Pacemaker over the second Pacemaker (which controls the power chambers). Deprived of the control of the first Pacemaker, the second

Pacemaker seems to be in the kind of position occupied by the Colonel of the regiment when he finds himself cut off from communication with his General. He tries to do his best to meet such demands as reach him, but his activity is not regulated as it should be, and is apt to be ineffective.

I have traced this application of the Principle of Increased or Decreased or Deranged Activity thus far to show how it leads, in the case of a particular symptom (the Dangerous Type of Irregularity), directly to that structure, interference with which threatens the patient's health or even life. This principle, therefore, is a guiding principle, which enables a "true scent" to be struck, and it therefore fulfils Mackenzie's demand. The cause of the danger, in cases of the Dangerous Type of Irregularity, is not the cessation of the beating of the upper chambers, but the weakening of the beating of the power chambers, the ventricles. The danger lies in the absence of control over the Second Pacemaker. Any treatment, therefore, which is capable of bringing the Second Pacemaker under control, even partially, must reduce the danger for the patient. Mackenzie had already found that the drug digitalis (foxglove) is capable of exercising this effect through its influence on the slowing nerve of the heart, which steadies the uncontrolled activity of the Second Pacemaker. Here, then, is a really scientific treatment.

As is well known, Mackenzie's method of administering digitalis in cases of the Dangerous

Type of Irregularity can be trusted to keep most of the victims of this disorder in fair health and strength for long periods. In those cases in which it fails, its failure is due entirely to the impossibility of bringing the second Pacemaker under control, and this again is due, probably, to some influence of a very potent kind acting on the Second Pacemaker. Thus, the research worker is directed to discovering what are these influences which have thrown the First Pacemaker out of action—decreased activity—and rendered the Second Pacemaker unduly active—increased activity. He is further faced by the problem why it should be that excessive activity of the Second Pacemaker exhausts the heart muscle. The reply may be made that the heart muscle becomes fatigued owing to the rapid rate at which it is called on to beat, just as soldiers become fatigued when their Colonel forces them to march too fast. But such an answer leads merely to another question—what is fatigue ?

CHAPTER XLI

THE DOOR OF THE CHAMBER

When the practitioners at St. Andrews reached this point in their work, they began to feel a sense of amazement. They had begun by observing a commonplace symptom, the Dangerous Type of Irregularity, and they had finished up with half a dozen most abstruse problems of medicine and physiology on their hands. They now devoted their attention to another simple set of symptoms —the feelings experienced in the skin in various conditions of ill-health.

Doctors are well acquainted with the fact that the skin often becomes unduly sensitive in areas or patches during the continuance of bowel and other troubles—as has already, indeed, been pointed out. They also know that sometimes patches of insensitiveness are found on the skin. It had been supposed that these patches remained, while they lasted, of exactly the same size, *i.e.* that they did not vary in size from one hour to another.

But when careful observations were begun, this idea was found to be quite incorrect. The workers at St. Andrews found what the Man of Burnley had found long before, that the sensitive patches, and also the insensitive patches,

were constantly changing their size. Their margins "fluctuated" continuously. Not only so, but the degree of sensitiveness and the degree of insensitiveness fluctuated also. Moreover, places on the skin which gave the owner of the skin a sense of heat when touched with hot objects, did not continue to give this sense. They seemed to grow fatigued, so that, after a time, no sensation of heat was felt when the hot object was applied to them.

What was the nature of this fluctuation? The only explanation seemed to be that it was due to the fatigue of certain cells or constituents of the skin and to the refreshment, and so increased activity, of certain other cells, as though relays of workers were carrying on a job, relieving each other from time to time. The matter was pushed farther by Professor David Waterston, of the St. Andrews University, who found that all points on the skin seemed to be able to feel heat and cold, and seemed to get tired if too long subjected to any of these sensations. This was by no means consistent with the orthodox view that the skin possesses "hot and cold spots" of a special kind. But it was entirely in accord with the idea that symptoms can be classified or arranged according to the principle of increased or decreased activity of organs. The application of heat to a particular spot tired the cells, and they grew sluggish and ceased to feel—their proper function. Then they rested, and became active again, and responded once more. In the sensitive areas there was increased activity of the cells, or

rather of the relays of cells; in the insensitive areas there was diminished activity. But whereas, where heat was applied, the cause of increased or diminished activity was obvious, in those cases in which sensitiveness or insensitiveness existed by itself, the cause was not obvious. It must lie elsewhere than in the skin, in some structure which was able to send increased calls for response to the skin, or in some structure which was sending fewer than its normal calls for activity.

Here again were a whole collection of abstruse medical problems crowding in on the astonished workers. It is obvious, they said, that it is not enough for us to know about organs of the body. We must know also about the cells of which organs are built up—those cells which, in the skin, seem to work in shifts, like the employees of a great firm. And as this idea came to them, their amazement deepened.

They had arrived at the deepest of all the problems of Nature—the living cell. They had come to the door of the Secret Chamber of Life.

CHAPTER XLII

THE LAW OF RELAYS

WHAT is vital activity ? How do organs live and move and have their being ?

A strange subject this to be engaging the rapt attention of busy panel doctors in a Scottish seaside resort ! Yet there seemed to be no escape from it. Either they must find out about this relay system of cells, which apparently characterized all the activities of all the organs of the body, or they could not hope to realize their aim—the gaining of knowledge which would enable them to prevent the breakdown of organs, to restore lost control, to foresee danger. With a new wonder in their hearts, these men addressed themselves to a study which had never before been attempted outside of a laboratory, which had never been approached, at any time, from the angle at which they were approaching it. They addressed themselves to the living cell.

Mackenzie had already foreseen this problem. He had turned in his need to the simpler cells of the vegetable world, and possessed himself of Darwin's great studies of that plant known as the Sundew, that plant which catches and devours flies unwary enough to alight on its traplike leaves.

"If a fly," he pointed out to his colleagues, "alights on a leaf of the sundew, hairs on the leaf bend forward and secure the insect. This happens all over the leaf, so that one cell of the leaf—that on which the fly alights—must jog another, and another another, and so on. You may call this the conveying of the call, or impulse. Again, the hairs bend down. That means a pull; so that not only do these cells jog one another, they also pull, they contract, they act. But for the leaf to bend, some of those cells which normally hold it erect on all sides must give way; so that some cells, instead of jogging and pulling, jog and let go or slack away. This indicates clearly that the cells must exercise some power of control over each other.

"There are no nerves in the leaf. Hence we are dealing here with a cell-to-cell form of the conveying of an impulse. Each cell, when called on, does its own particular bit, whether pull or slack away, and at the same time passes on the call to its neighbour. Moreover, the bending of the hairs lasts a long time, so long that it seems probable that no one set of cells could achieve it. There are quite certainly relays of cells at work. It is possible by various means to exhaust all the relays, and then the hair cannot bend until a rest has been taken."

Mackenzie knew that he was describing certain processes of the animal body as well as of the vegetable body. His hearers also realized this. They saw that he was telling them that when a cell performs its function, whatever that function may be, it jogs a neighbouring cell at the same time, or, to use a more exact term, sends out an

impulse. This impulse makes the neighbouring cell active, and it, in its turn, sends out its impulse. Thus the organ, of which the cells are the component parts, performs its office, and at the same time throws out an impulse or call to neighbouring organs. This call may be a loud one, or it may be a very quiet one—that depends entirely on the number of cells in activity at any one given moment. If the relays are small, the call will be feeble. If all the cells are at work at the same time, the call may be overwhelming in its intensity . . . as is seen during the violent contractions of the womb in childbed, when the muscles of the whole body are called into play, and when the patient perspires freely and may vomit and exhibit other signs. Thus, large relays of cells—large numbers in activity at the same time—give rise to symptoms of a very diversified kind. Small relays give rise to few or no symptoms. But the larger the relays, necessarily, the more rapid the exhaustion of the organ.

As they realized the bearing of these ideas, the doctors began to understand the terms "Rest-force" and "Reserve-force" as applied to the heart muscle. They could answer the question, "What is fatigue?" They began to see that the activities of organs are graded in the most exquisite manner, according to the needs of the moment. When a man lies at rest, the relays of cells "beating" in his heart are small ones. When he gets up and is active, he calls on his "reserve force," and the relays are enlarged in number. When there are no more cells to

add to the relays, his heart is on the point of exhaustion.

That is only another way of saying that the time allowed for rest is shortened, for each cell, as activity increases. Increased activity, then, means shorter rest. And the smaller the available number of healthy cells in any given organ, the shorter must this rest time be for each cell during strenuous activity.

It was easy to understand now why the uncontrolled action of the Second Pacemaker should be to exhaust quickly a heart muscle already damaged and beginning to fail. The reserve force, already depleted by the destruction or enfeeblement of cells, was rapidly used up by the quick rate imposed on the organ. The number of cells was too small to fill up the relays, and at the same time keep a sufficient number of relays in action. It was easy, too, to understand the fluctuations of sensation observed in the skin. Further, the application of this law of relays or law of fluctuation explained a large number of symptoms which had formerly been inexplicable. It cast a new light on the obscure problem of exhaustion, that earliest of the signs of ill-health, and it showed why a poisoned system (by the germs of disease, by alcohol, and so on) may lead to sensations of breathlessness and of pain over the left side of the chest, as in the "soldier's heart." There is increased activity here of controlling structures such as the First Pacemaker. The result is that the heart is compelled to respond with excessive violence. Its rate is increased

abnormally. The relays are enlarged on slight provocation, and the organ is thus wearied out. Breathlessness and pain occur as they always do when the heart muscle is under excessive strain. But the muscle itself is healthy. There is no heart-failure in the true sense.

Again, it explained why a healthy man, over-exerting himself, may suffer from breathlessness and pain in the chest after the same manner as a victim of "soldier's heart." The relays are enlarged until heart exhaustion is produced.

It dawned suddenly on the doctors, as they contemplated these matters, that a symptom of disease is only an exaggeration of or an interference with a normal response. The victim of "soldier's heart" becomes breathless and exhausted sooner than, but not in a different manner from, a healthy individual. The victim of the Dangerous Type of Irregularity becomes breathless because the normal response of his heart is hindered by absence of the controlling influence of the First Pacemaker. The victim of true heart failure becomes breathless because he possesses insufficient relays of cells to maintain the needful strong beats.

The law of relays, the law of fluctuation, had proved a golden key with which to unlock numberless secret places.

I can touch here on only one more of these—the symptom of the sense of exhaustion. The study of this symptom by the new methods showed that it depends on the movements of the "blood mass" from one area of the body to another. There are relays of small blood-vessels

in the belly, and when these are all at work together, blood mass is shifted out of this region of the body to the muscles and the brain. But if the relays are too small, if the time of rest is insufficient for each cell, or if control is lost, the vessels become fatigued or become flabby. Blood mass sinks back to the belly. The muscles and brain are deprived of blood. This symptom, exhaustion, then may indicate one of the many causes of such lack of control or lack of relays, and so may open up a new knowledge of the beginning of disease and of the power to foresee danger.

CHAPTER XLIII

THE COMING OF THE TWILIGHT

SHORTLY after he came to St. Andrews, Mackenzie knew definitely that he was stricken with angina pectoris, the disease he had studied so intensively, the disease from which his brother had died in his pulpit. He hid the knowledge in his heart, and went on with his work.

But he realized clearly that his time was now short. There was not a moment to lose if he was to set his Institution on a sure foundation, both scientific and financial.

Money was difficult to obtain, though some of his old friends had rallied round him and given him most handsome assistance. I do not mention their names, for I do not think that they would wish it. This help, though, was not enough. Mackenzie resolved to devote his last strength to working as a consultant once more and earning fees that he might give them to his beloved work, to that suffering humanity which had commanded all his energies all his active life.

I confess that this last resolve fills me with wonder and reverence. It was so like him, so selfless. For he knew that the strain of railway travelling, of staying away from home, of hurrying

back, of teaching, of examining patients, must inevitably shorten that narrow span between himself and the grave. He never flinched, he who had never turned his back on any call of duty. He journeyed to London, to the Riviera, all over Scotland. He spent himself in ceaseless work at the Institute. He remodelled his great book on *Diseases of the Heart*, so that it might contain all the new work and all the new ideas. In addition, he lectured in London (to Sir Almroth Wright's students), in Edinburgh and in Dundee and Aberdeen. He wrote numberless articles for the medical journals. He collected all his notes about the fell malady which, even as he wrote, clutched at his heart, and produced a monumental book about it. He wrote another book about the relationship of heart diseases to pregnancy, and he edited, with Dr. Orr, a new edition of his smaller heart book. As he looked at his "boys," the doctors who must carry on his work, his eyes were brave and unafraid. How he believed in them! How this man believed in all his fellows!

But the shadows of the night lengthened on his life. When he came first to St. Andrews, he could play two rounds of golf without distress. After a time, he could play only one round. Then only nine holes. And then, so soon, only a single hole. He put his beloved clubs away. There was still his Institute. He could still travel and earn. He came to London for the last time as an active physician, and when I saw him there, in the Reform Club, told me that he had promised his wife he would not do it again.

"I felt that the fee I was offered might just make a bit of difference," he confessed shyly. "The Institute needs every penny."

He returned home. His visits to the Institute grew fewer, but his "boys" came to see him. He worked at home, with his wife and daughter—that "good, dear wife," as he called her once in my hearing when, with eyes that were suspiciously moist, he vouchsafed the information that she had encouraged him to leave Harley Street and go to St. Andrews, and had thereby sacrificed, without one care or thought, all the possible advantages of prolonging that most enormous and most valuable practice.

One day he could not walk even so far as his Institute.

The Institute must not suffer. The time, he said, had come to resign the active Directorship. No one could dissuade him, and Dr. Maitland Ramsay was appointed. He walked only in his garden, or drove with "Dorothy" in her car. It was almost the twilight.

Yet his gay heart was gay as ever. Only a few months before, he had even played one of those merry jests he loved so well, on his wife. He had heard, at the Institute, that he had been appointed a Consulting Physician to the King in Scotland. He seized the telephone, and rang up his home.

"Is that you? . . . Well, the King's doctor is coming to lunch. See you have a good meal for him!"

The joy of taking that honour home to share

with Lady Mackenzie was, or so I was told, dancing in his eyes.

In the early days of 1924, he was compelled to go to bed. He wrote me a letter full of cheer about a visit he had received from Sir Walter Fletcher. Sir Walter had promised to ask his Council for a grant for the Institute, and Mackenzie's joy knew no bounds. I do not think that the distinguished Secretary of the Medical Research Council ever gave more signal proof of his real leadership of scientific research in this country, nor yet of the goodness and wisdom of his heart. That letter ended, I remember, with the words :

"I am a terrible 'crock' now, unable to get out of bed ; but happy as the day is long, going over old times and fighting my battles again."

CHAPTER XLIV

INTO THE NIGHT

He rallied a little, and was advised to come to London. In the summer months he made a last visit to St. Andrews, and then took possession of a flat he had rented in Albert Hall Mansions. It was there that I saw him for the last time, as I have already described.

These final months were made dreadfully hard to bear by the anguish which he suffered, attack of pain succeeding attack of pain. But still he worked on, into that night which came upon him with flying feet. There were the proofs of his big book to finish, and there was the review of the work at the Institute to write. He completed both tasks, and the review has now been published under the title of *The Basis of Vital Activity.**

Christmas came, and the New Year. He knew that he had come to the end, and foretold the period of his death with wonderful certainty. The last proofs passed from his hands. The figure of Death, so long defied, drew close to his side. There was one last seizure, and then a period of gentle sleep. In the night of the 25th and 26th of January 1925, the bravest and truest man I ever knew went out, softly and serenely, to his rest.

* *The Basis of Vital Activity.* Faber & Gwyer. 6*s.* net.

In these last hours of weakness his mind was released to dwell with those he loved both here and in that hereafter to which he journeyed.

His wife did not leave him for a moment, and again and again he renewed to her the confession of the deep affection in which he held her. He said that her presence made him strong to face the great night, and that the sight of her face filled him with joy. Unconsciousness came, and then, if his thoughts were at all of the circumstances of past days, I think that they may have gone back to see once more that beacon lamp, lit by his mother's hands, and set, each Saturday night, in the window of the farmhouse of Pickstonhill, to guide his young footsteps, in the last miles of their journey, across the darkness between Scone Village and the chemist's shop at Perth.

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